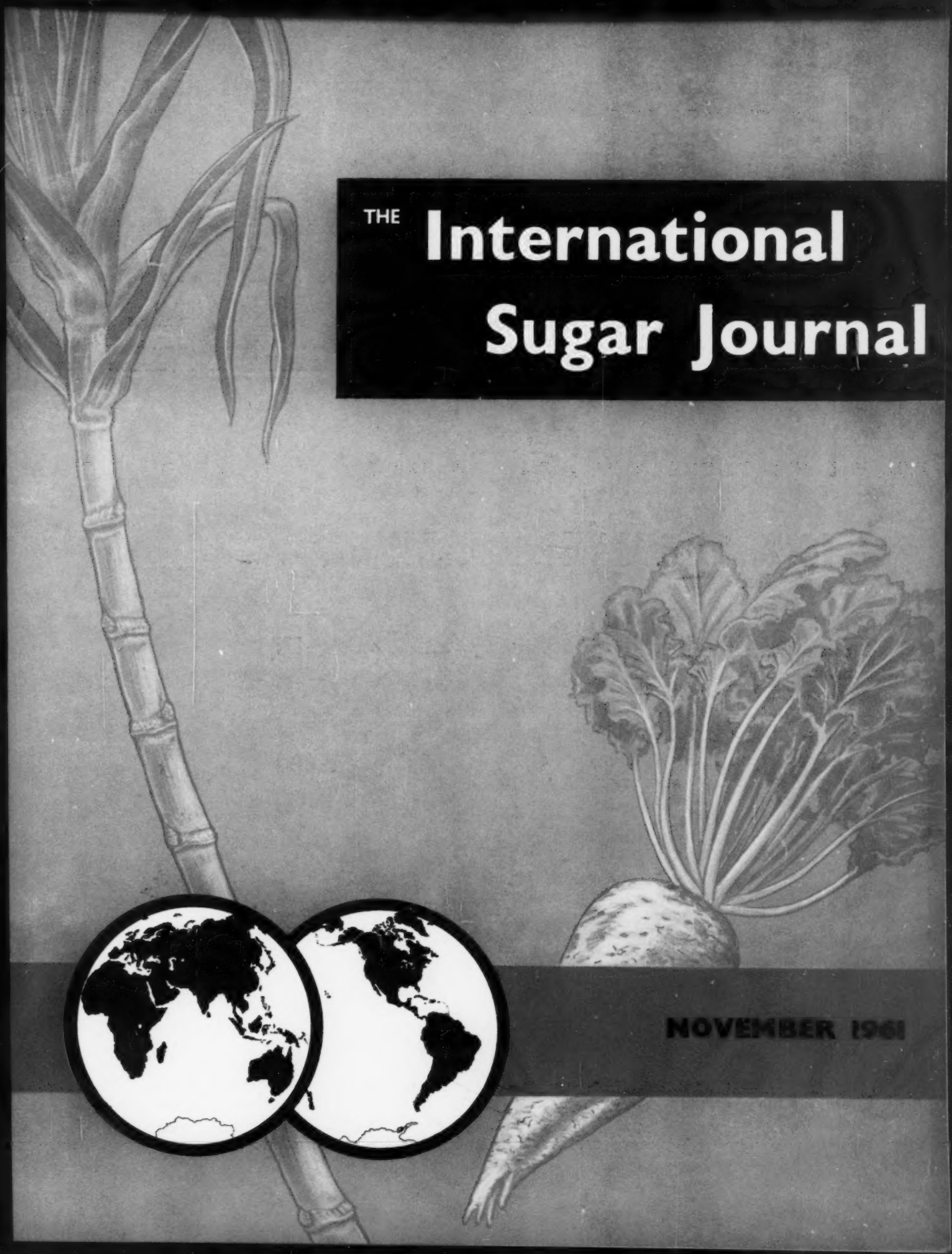
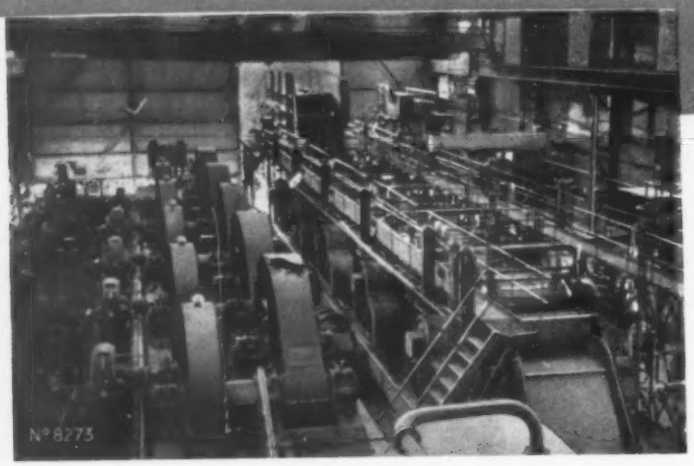


THE International Sugar Journal

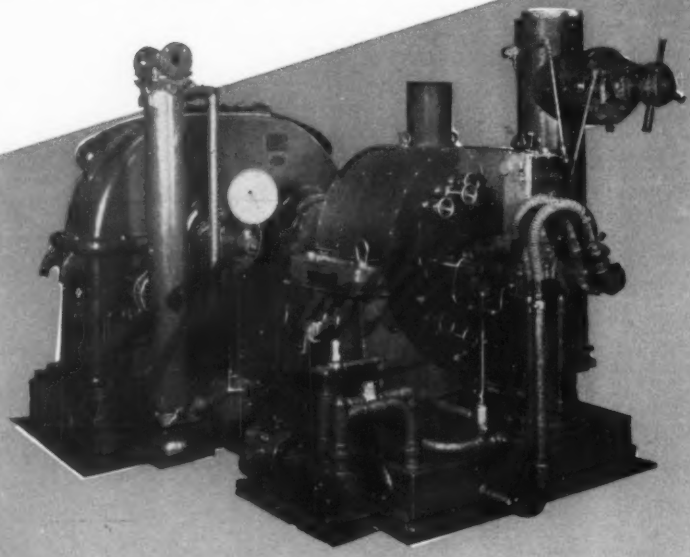
NOVEMBER 1961

THE POWER BEHIND THE DRIVE



IN THIS 15 ROLLER 36 in × 72 in 2500 TONS CANE/DAY PLANT WHICH THE MIRRLEES WATSON CO. LTD. SUPPLIED COMPLETE TO THE GAL OYA FACTORY, CEYLON

IS A MIRRLEES TURBINE



ONE OF THE 5 450 B.H.P. TURBINES DRIVING THE GAL OYA MILLING PLANT.

66 MIRRLEES TURBINES ARE IN OPERATION AS SUGAR CANE MILL DRIVES THROUGHOUT THE WORLD GIVING A TOTAL OUTPUT OF 13,125 B.H.P.

THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS—45 SCOTLAND STREET, GLASGOW, SCOTLAND *Cables:* "Mirrlees Glasgow"
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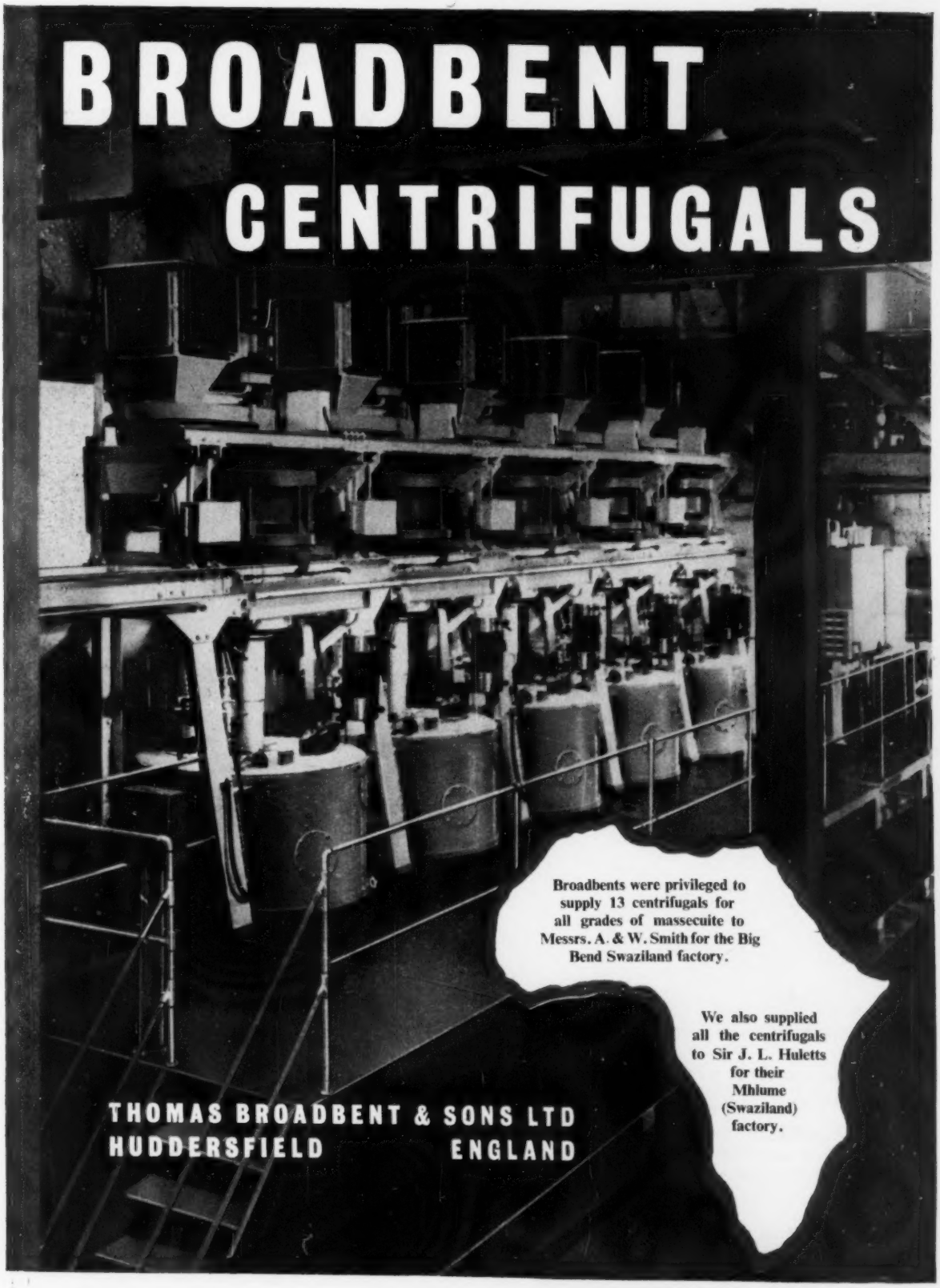
BROADBENT CENTRIFUGALS



Broadbents were privileged to supply 13 centrifugals for all grades of massecuite to Messrs. A. & W. Smith for the Big Bend Swaziland factory.

We also supplied all the centrifugals to Sir J. L. Huletts for their Mhlume (Swaziland) factory.

THOMAS BROADBENT & SONS LTD
HUDDERSFIELD ENGLAND

ii

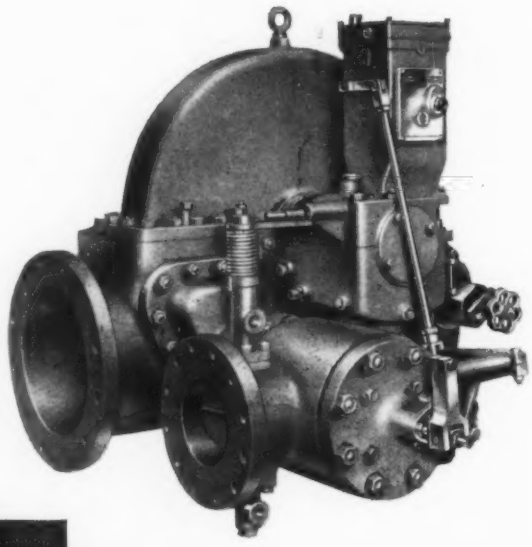
THE B & M SINGLE STAGE

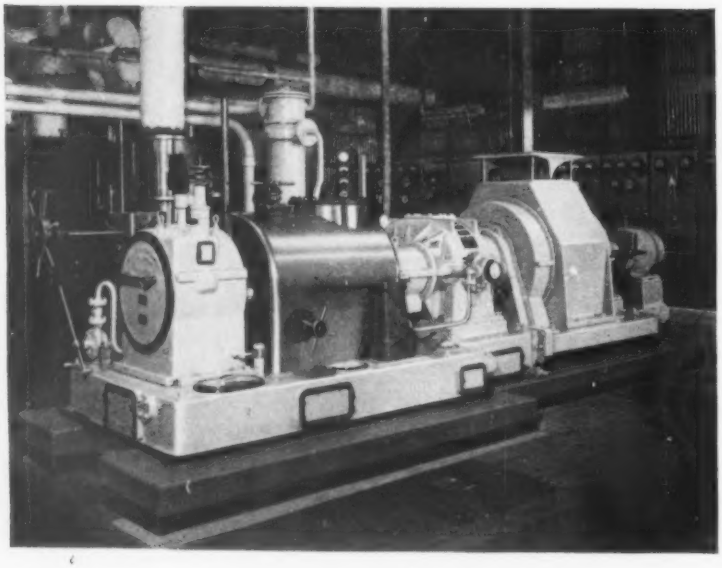
SUGAR MILL TURBINE

Simple in design
Reliable and Economical
in Operation

25 to 1,200 h.p. direct coupled at speeds of up to 5,000 r.p.m. max. or supplied with reduction gearing of any desired ratio.

'B & M' single stage variable speed mechanical drive turbine, particularly adapted for SUGAR MILLS, PUMPS, etc.





750 kw back pressure turbine installed at Farleigh Sugar Mill, Queensland.

1,500 kw 'B & M' back pressure turbine and several steam engines also installed.

Many hundreds of 'B & M' Steam Turbines and Steam Engines have been supplied to the Sugar Industry for electrical and mechanical drives for:

CRUSHERS
MILLS
CANE KNIVES
PUMPS ETC.

Also **VACUUM PUMPS** Reciprocating and Rotary types.
'ARCA' Pressure and Temperature REGULATORS

With the considerable resources of our up to date factory available, we are always interested in receiving enquiries for the manufacture of machinery to YOUR OWN DESIGNS.

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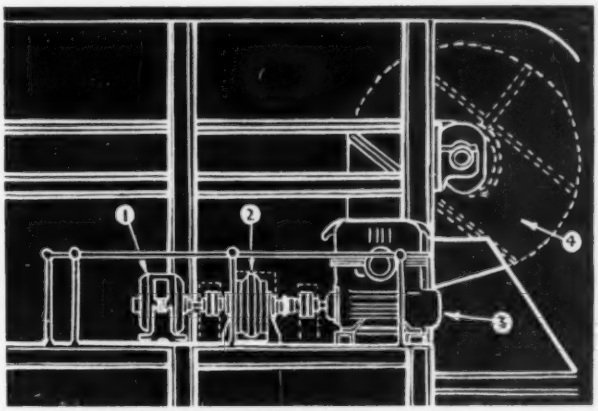
BIRMINGHAM 16 · ENGLAND

'Mirrlees'

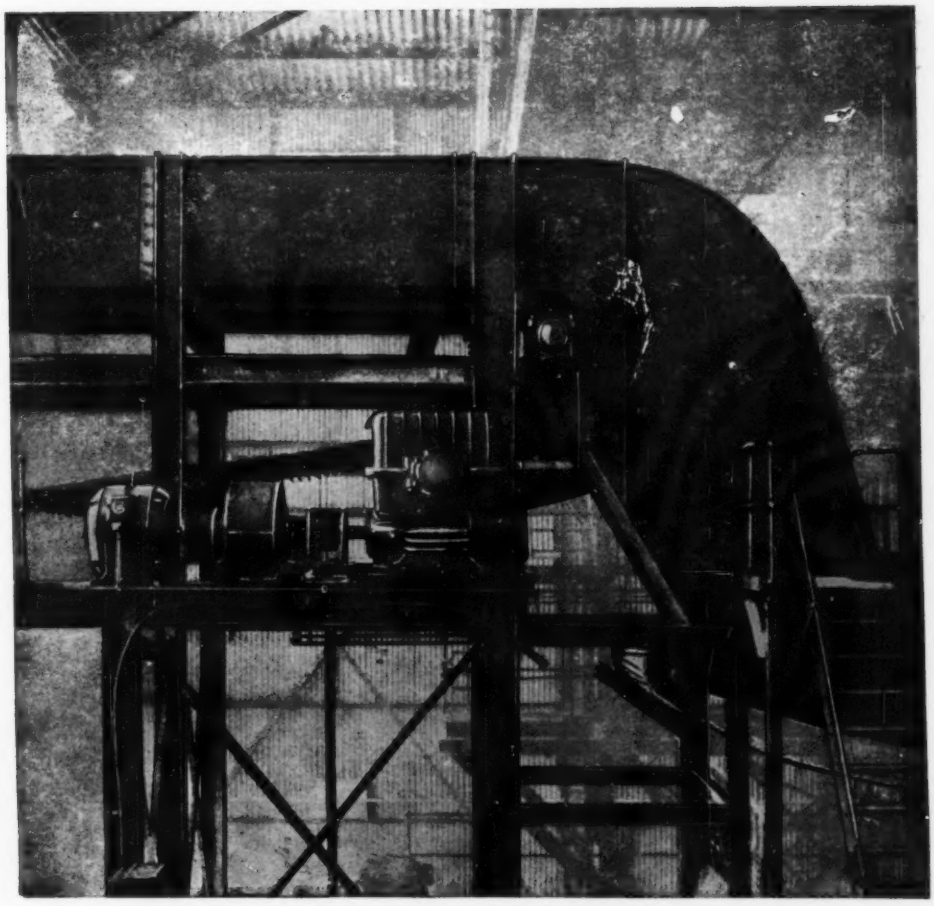
CANE CARRIER DRIVE

BY CONSTANT SPEED ELECTRIC MOTOR



On the above diagram,

1. Squirrel cage motor.
2. Variable speed constant magnetic coupling.
3. Worm reduction gear box.
4. Spur gear.



Cane Carrier Drive installed in the Gal Oya Factory, Ceylon.

In this improved drive for Cane Carriers, the electronically controlled coupling gives smooth shockless starting, variable surface speed for close control of cane feed and prevents cane knife chokes. The drive employs a compact reduction gear and standard squirrel cage motors and starters.

THE MIRRLEES WATSON COMPANY LIMITED

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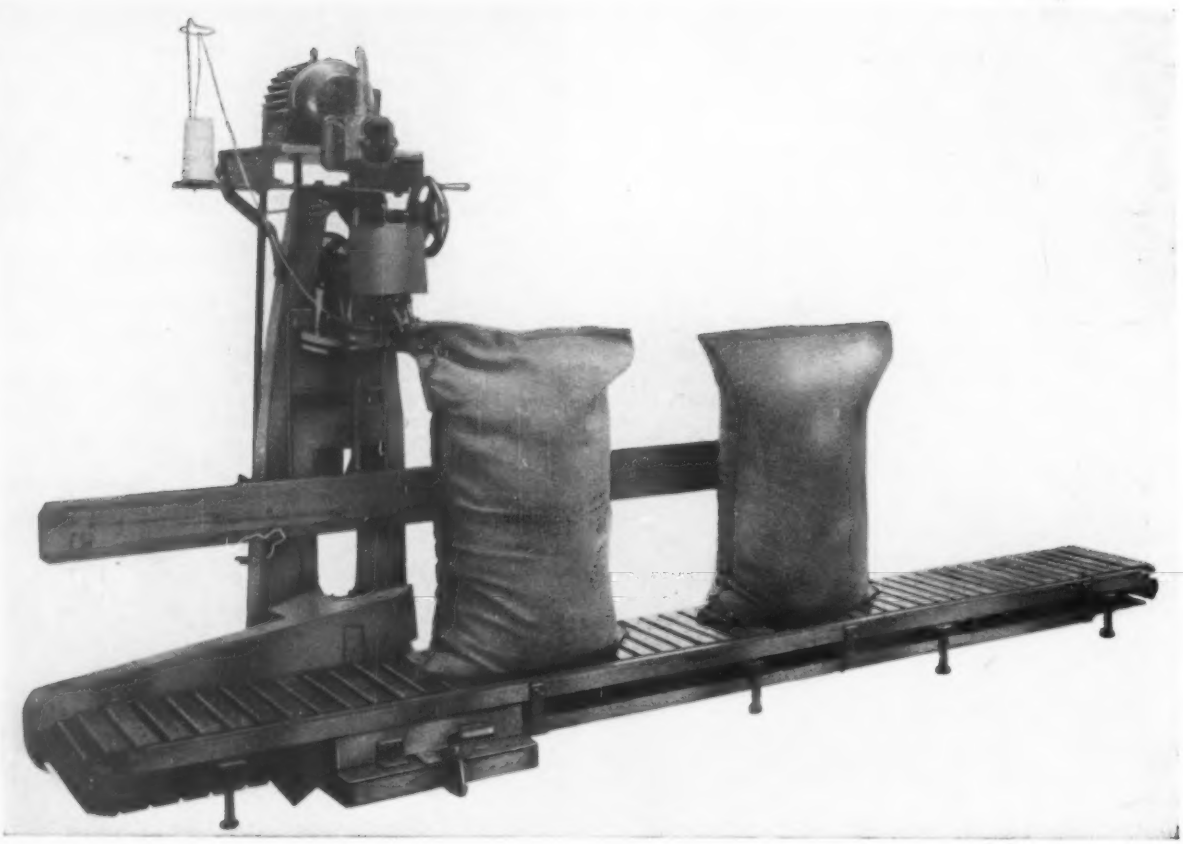
LONDON OFFICE—38 GROSVENOR GARDENS, S.W.1. TELEGRAMS "MIRRLEES SOWEST LONDON"

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lines Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 *h.p.* *Shipping weight :* 14 *cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

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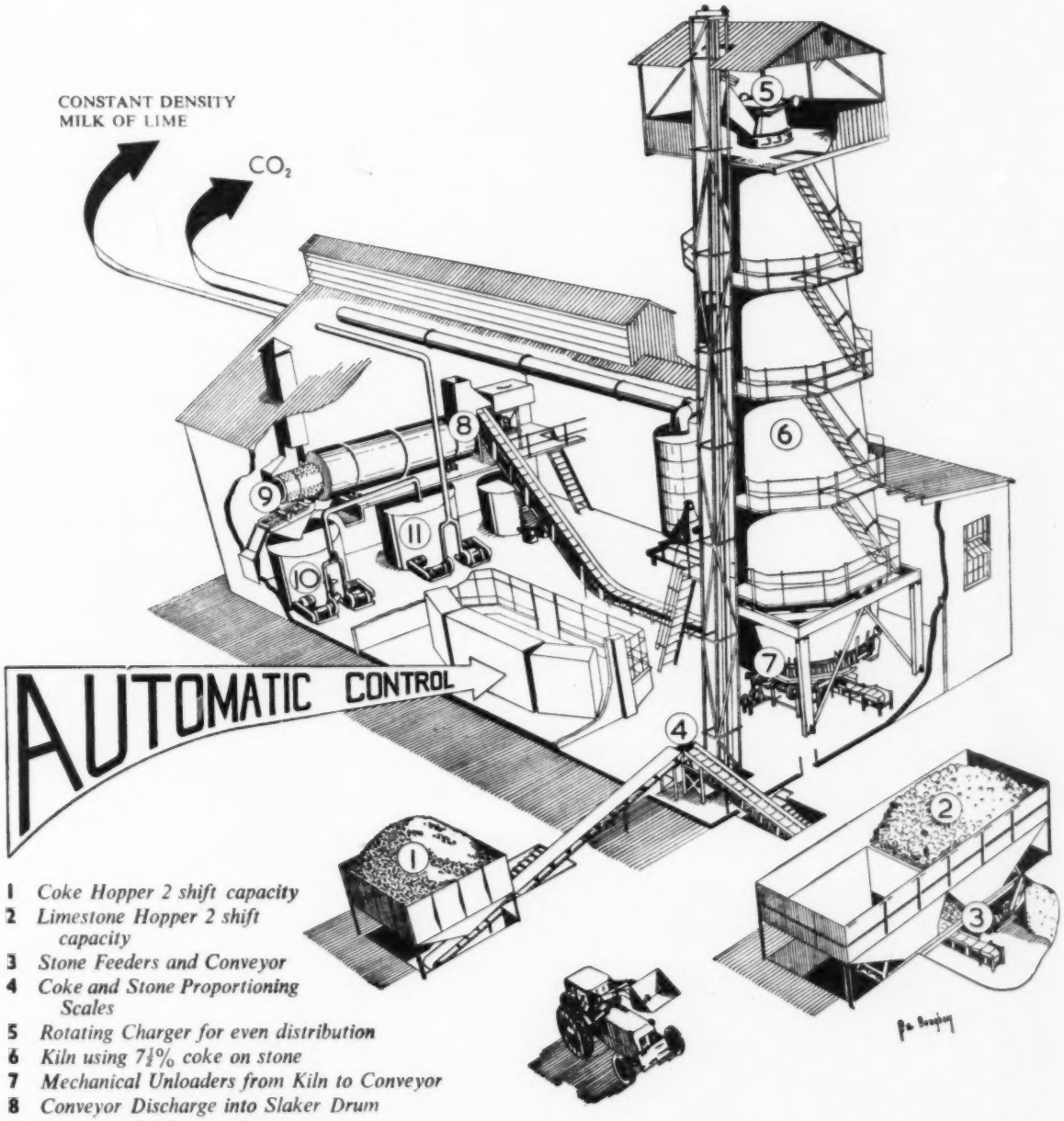
MILK OF LIME PRODUCTION

USING ONLY ONE OPERATOR PER SHIFT

AS SUPPLIED TO THE BRITISH SUGAR CORPORATION



1 *Coke Hopper 2 shift capacity*
2 *Limestone Hopper 2 shift capacity*
3 *Stone Feeders and Conveyor*
4 *Coke and Stone Proportioning Scales*
5 *Rotating Charger for even distribution*
6 *Kiln using 7½% coke on stone*
7 *Mechanical Unloaders from Kiln to Conveyor*
8 *Conveyor Discharge into Slaker Drum*
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10 & 11 *Milk of Lime Density Correction and Storage Tanks*

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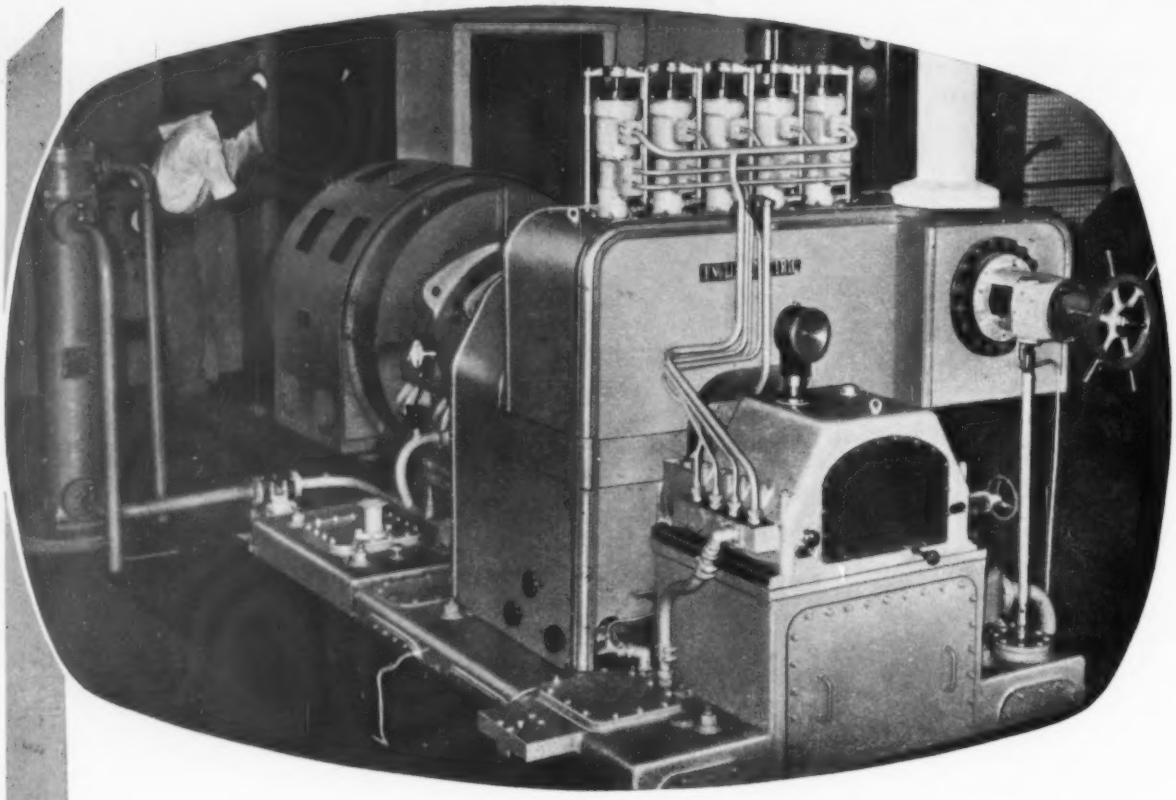

An 'ENGLISH ELECTRIC' 1,500 kW C.M.R., 8,000/1,500 r.p.m. geared back-pressure steam turbo-alternator set installed at Miwani Sugar Mills (Kenya) Ltd. This machine provides 50,000 lb/hr. of process steam at 10 p.s.i.g. and the electrical power for running the mill.

maximum economy

ELECTRICAL POWER AND PROCESS STEAM FROM ONE UNIT

'ENGLISH ELECTRIC' industrial steam turbo-alternator sets provide electrical power and process steam from a single installation with maximum economy. The range of back-pressure and condensing steam turbines covers most industrial needs and meets wide variations of steam and electrical loads. Electrical outputs range from 500 kW to 6,000 kW.

'ENGLISH ELECTRIC'

steam turbines

THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2

Steam Turbine Division, Rugby

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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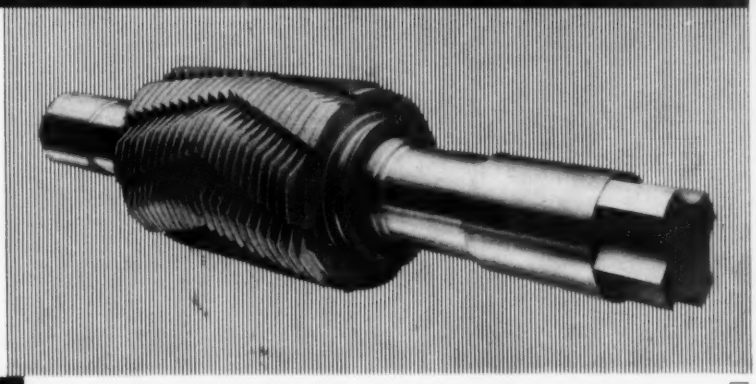
One manufacturer for your complete sugar factory:



STORK-WERKSPOOR

MILLING PLANT:

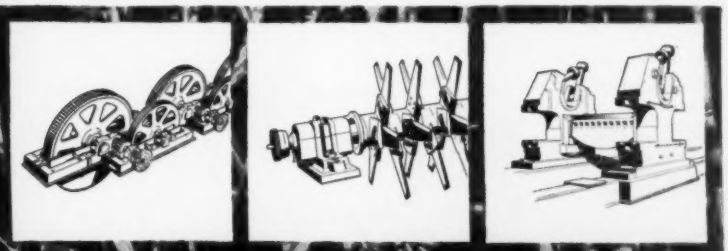
Mill rollers with coarse grained cast iron shell, rough surface, high quality steel shaft.

Gearings

Knives with two edges of wear resisting special steel

Roller casings

For all sugar machinery apply to STORK - Hengelo - Holland.

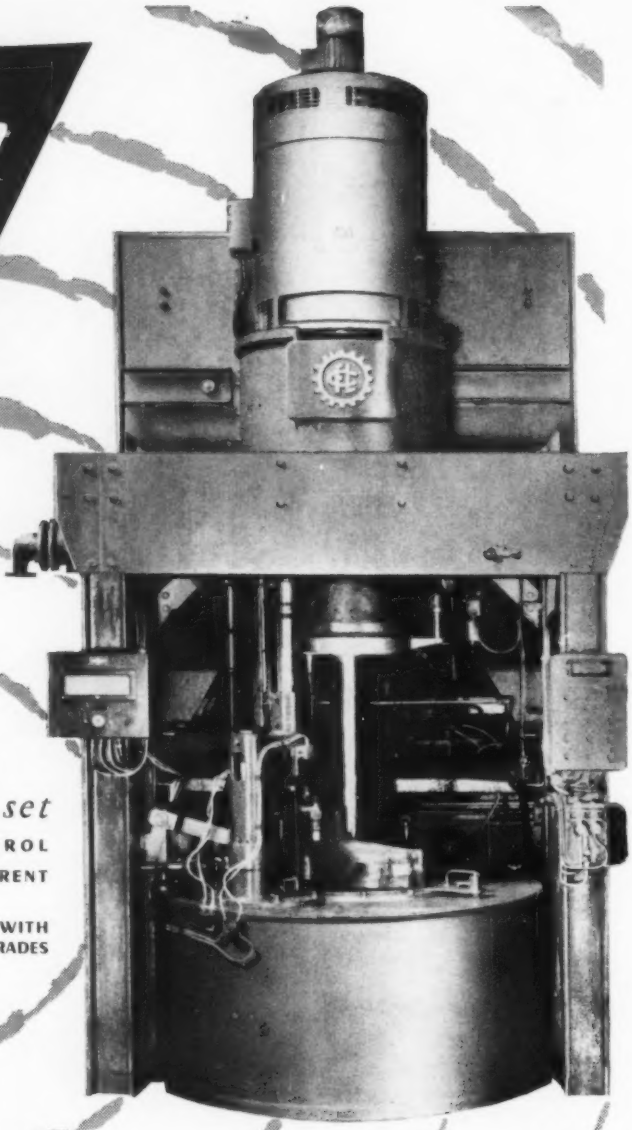


VMF NEDERLAND
VEREENIGDE MACHINEFABRIEKEN STORK WERKSPOOR

Fully automatic!

the new

CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

S.A.G. - PARIS

FIVES LILLE - CAIL

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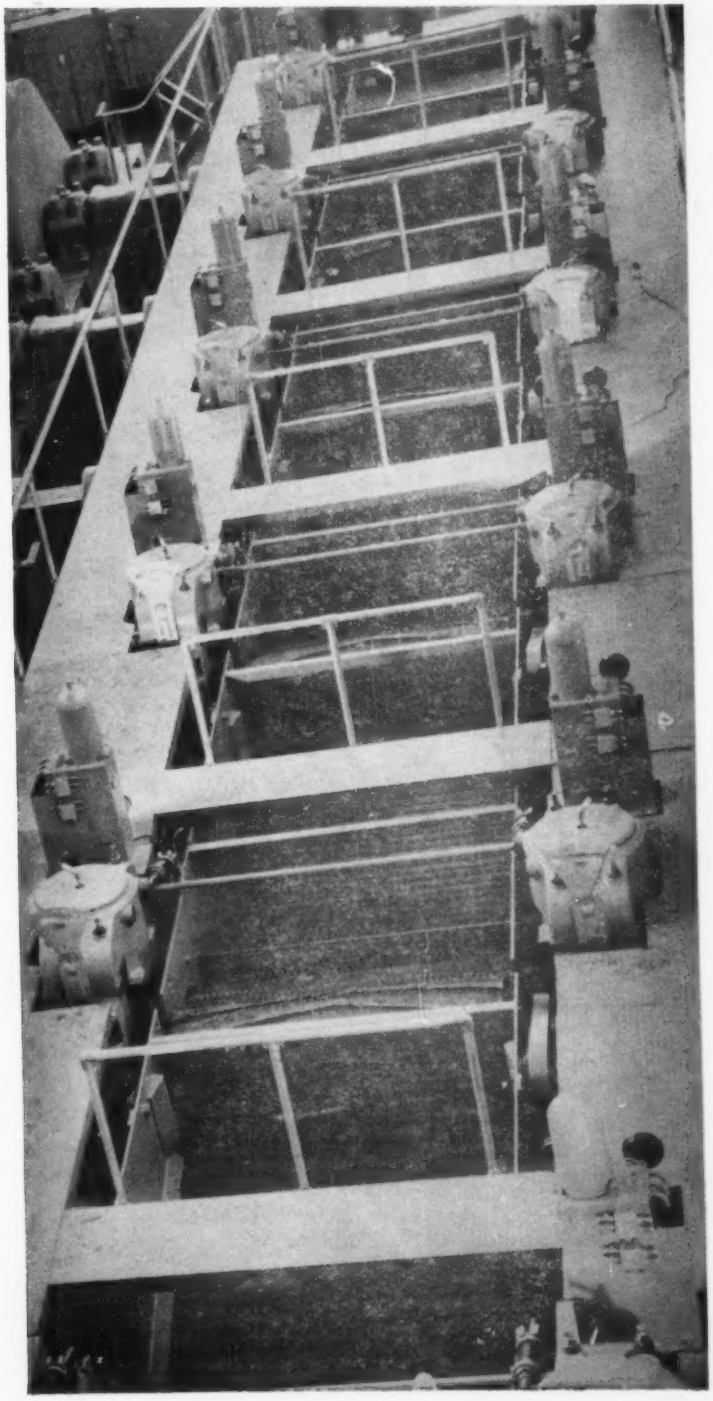
Why the rapidly increasing demand for Farrel sugar mills?



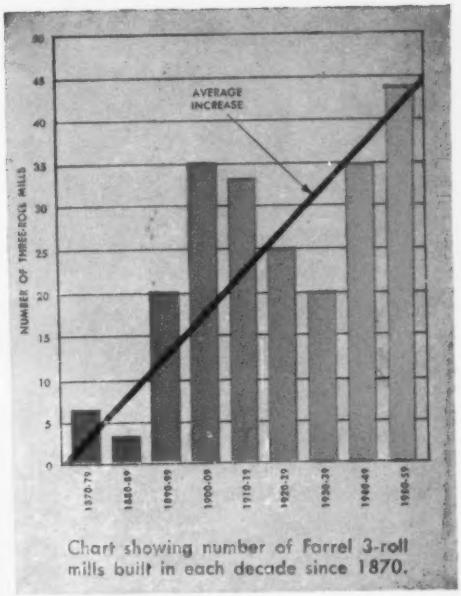


Chart showing number of Farrel 3-roll mills built in each decade since 1870.

Because, in recent years Farrel has pioneered a number of major refinements in sugar-grinding equipment.

For example, improvements in hydraulic ram mechanisms to maintain uniform roll pressure, and the introduction of force-feed rollers have resulted in increased sucrose extraction. Automatic lubrication of roll journals and centralized drive control for individual mills reduce costs for operating personnel.

New designs for side and top caps have been developed to permit fast, vertical removal of all rolls for regrooving and other maintenance. Time required for removal of hydraulic pistons and intermediate carriers has also been reduced.

Stronger housings and safeguards against corrosion add years to the life expectancy of mills. New hardened crownwheels, fabricated gears and rubber-belt carriers are establishing records for durability.

These are only a few of the recent innovations that have led to the increased demand for Farrel mills. For the full story, send for a copy of bulletin 312.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT, U.S.A.
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N.Y.

FARREL®

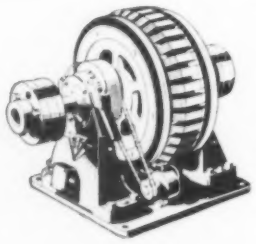
FB-1201

The technical "know-how" of DRIVE CONTROL!

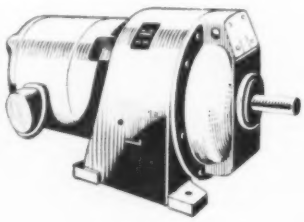
The Heenan-Dynamatic Variable-Speed Coupling is a device which is coupled to a constant speed motor in order to provide a controlled variable-speed output. One element of the Coupling runs at motor speed, the other runs at any lower speed desired, thus giving stepless speed variation. That is the beauty of fully-automatic speed variation and speed control — brought to *almost every industry* by the wide range of Heenan-Dynamatic Variable-Speed Couplings and Drives.

It is a system that has solved problems which have defied conventional solution. Throughout industry in fact, Heenan & Froude have become the authority on all aspects of speed control.

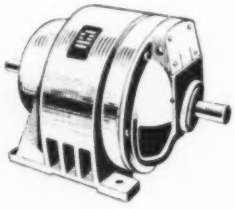
Remember – There is no Substitute for experience



DYNAMATIC



DYNASPEDE



AJUSTO-SPEDE

DRIVES BY HEENAN & FROUDE

ENGINEERS, WORCESTER

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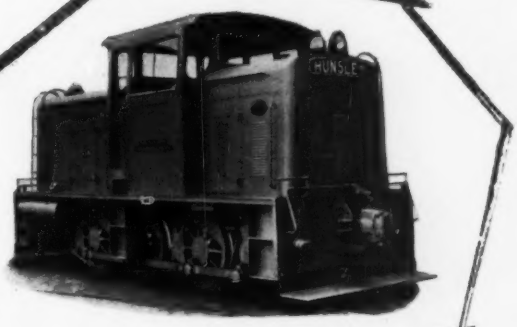
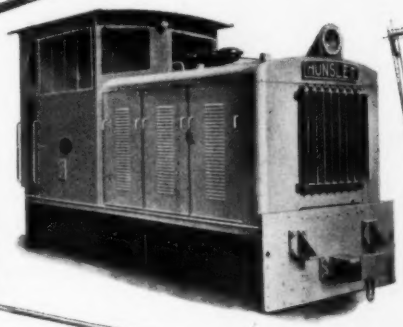
SERVING THE SUGAR INDUSTRY

Hunslet Locomotives and Tractors



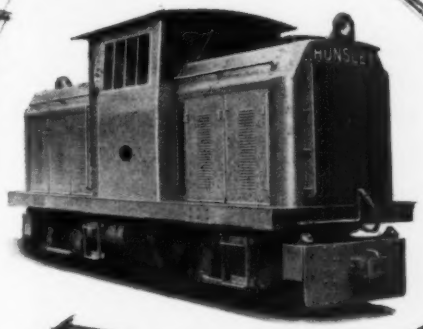
204 h.p. 0-6-0 type diesel locomotive.



101 h.p. 0-6-0 type diesel locomotive.

230 h.p. "Articulated" locomotive.

On estates and plantations all over the world Hunslet locomotives are in daily use, maintaining their reputation for absolute reliability and efficiency. All Hunslet locomotives, wherever they may be serving, are backed by a comprehensive spares and service scheme.



A new Hunslet Product

The ST.125 Tractor fitted with sugarcane handling attachment, specially designed for collecting, lifting and loading sugarcane into large capacity trailers and trucks.

Full details gladly spplied on request.

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APV have been responsible for the development, design, construction and commissioning of complete alcohol plants all over the world. They have the experience, resources and organisation to deal with complete projects for the production of all types of alcohol from molasses, as well as from dates, rice, grain and other raw materials.

Alcohol projects undertaken by APV in recent years include the following:—

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900,000 galls./year of rectified spirit from molasses.

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750,000 galls./year of alcohol and 330,000 lb./year of dried medicinal yeast from rice.

COLONIAL SUGAR RECTIFYING CO., AUSTRALIA.
2,100,000 galls./year of absolute alcohol or rectified spirit.

MODERN CHEMICAL INDUSTRIES LTD., IRAQ.
360,000 galls./year of rectified spirit from dates.

SUGAR MANUFACTURERS' ASSOCIATION, JAMAICA
2,100,000 galls./year of absolute alcohol from rum.

MACNAB DISTILLERIES LTD., SCOTLAND.
360,000 galls./year of grain whisky.

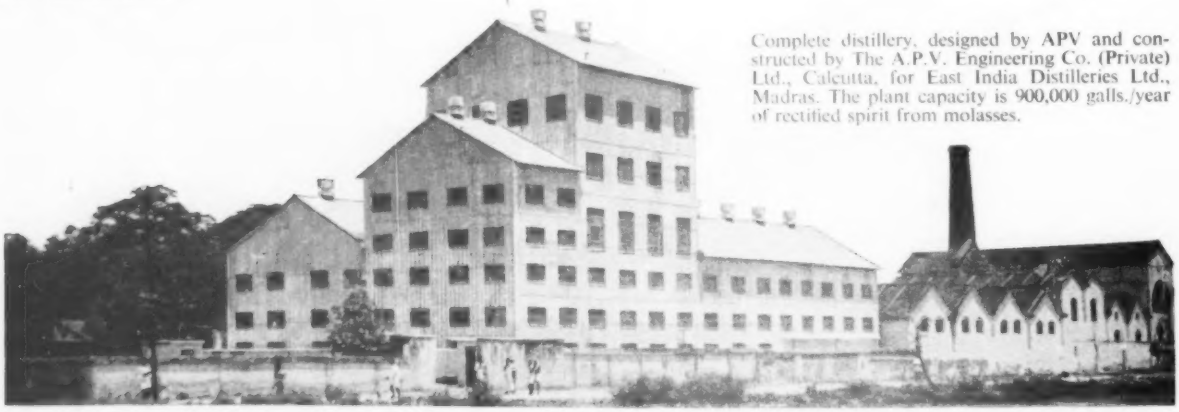
PREMIER SUGAR MILLS, PAKISTAN.
Fermentation plant for 600,000 galls./year distillery.

DYER-NEAKIN LTD., INDIA.
360,000 galls./year of high quality potable rectified spirit from molasses.

WRAY & NEPHEW LTD., JAMAICA.
180,000 galls./year of gin spirit from molasses.

S. A. DAVSON & CO. LTD., BRITISH GUIANA.
360,000 galls./year of rum from molasses wash.

BEN NEVIS DISTILLERY LTD., SCOTLAND.
180,000 galls./year of grain whisky.



Complete distillery, designed by APV and constructed by The A.P.V. Engineering Co. (Private) Ltd., Calcutta, for East India Distilleries Ltd., Madras. The plant capacity is 900,000 galls./year of rectified spirit from molasses.

APV CHEMICAL ENGINEERING DIVISION

Contractors and engineers to the fermentation and alcohol distillation industries. Plants for grain cooking, saccharification, yeast culture, fermentation, CO_2 recovery, etc. Stills and other equipment for the manufacture of all types of alcohol including whisky, gin and rum.

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Objective Consulting and Conscientious supervision of execution of projects all along the line of SUGAR will improve

PERFORMANCE
ECONOMY
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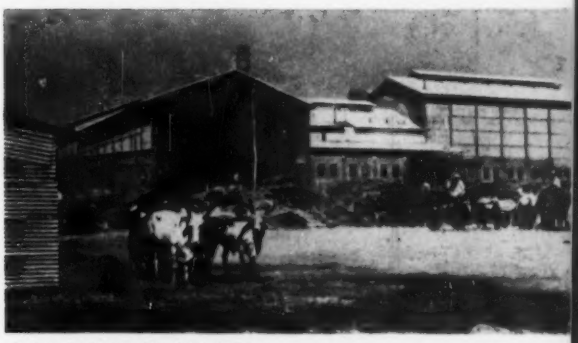
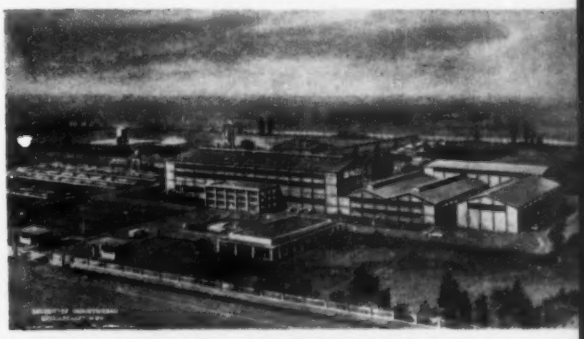


CANE SUGAR PLANT INDIA

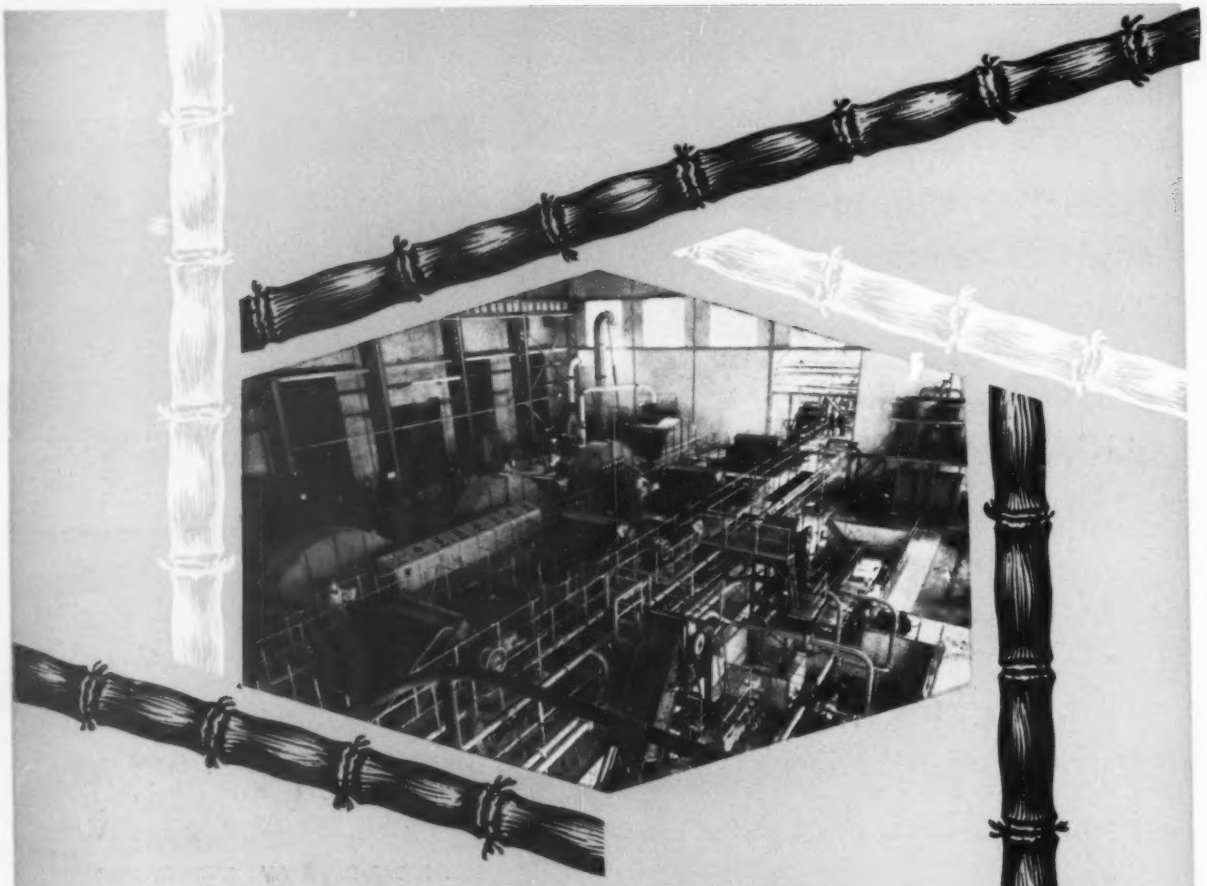
BEET SUGAR PLANT AND REFINERY IRAQ



BEET SUGAR PLANT AND REFINERY IRAN

SALZGITTER INDUSTRIEBAU GMBH

SALZGITTER-DRUTTE



SKODA SUGAR CANE CRUSHING STATION

driven by individual economic steam turbines controlled from one central panel secures

- **easy attendance**
- **accurate regulation**
- **low consumption of steam**
- **fuel savings**

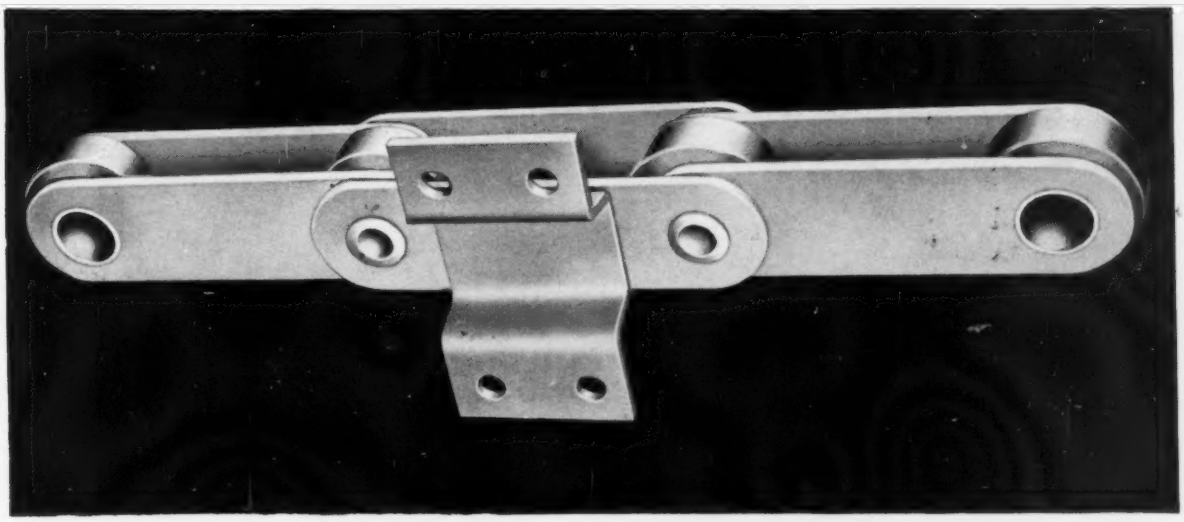
We deliver the complete machinery and equipment as well as individual equipment for cane and beet sugar factories and refineries and carry out reconstructions.

Dozens of sugar mills constructed in many countries in past years prove the traditional high standard of the Skoda equipment.

TECHNOEXPORT Foreign Trade Corporation for Export of Complete Industrial Plants, Praha, Czechoslovakia.

These are our strong points–

- Specially designed heavy gauge side plates
- 20% more bearing area
- 15,000 lb. and 30,000 lb. breaking load
- Available from stock



RENOLD SUGAR ELEVATOR CHAINS

These Renold conveyor chains are designed and manufactured for heavy and arduous duties in the cane sugar industry and offer the attractive combination of high strength and low price plus the advantage of providing 20% more bearing area than most competitive makes. They have cast iron rollers, but rollers of hardened material can be fitted as an alternative, and for corrosive conditions chains can be supplied in stainless materials. Attachments are fixed on one side of the chain at 4 pitch spacings.

RENOLD

RENOLD CHAINS LIMITED · MANCHESTER · ENGLAND

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The Crystalloscope is an instrument designed for controlling and improving the process of sugar boiling. It also finds application in some fields of the pharmaceutical and chemical industries.

CRYSTALLOSCOPE

The Crystalloscope revolutionizes the conventional process of sugar boiling by dispensing with the use of sampler tap, and increasing the economy of sugar production by 15%.

The high efficiency involved in its use makes the Crystalloscope suitable for checking the process of preparing primary, intermediate and final products as well as refinements.

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Sugar Factories Equipped with John Thompson Steam Generation Plant

Country	J. T. Boilers Producing Tons of Sugar per Year	Country's Estimated Sugar Production (tons).
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Australia	51/574,800	1,360,000
Brazil	11/3,500	2,880,000
British Guiana	25/300,000	300,000
British East Africa	1/25,000	145,000
British West Indies	4/52,250	580,000
Ceylon	2/36,800	45,000
Dominican Republic	6/188,000	890,000
Egypt	1/108,500	300,000
Fiji Islands	12/102,000	192,000
India	114/504,110	2,275,000
Mexico	1/30,000	1,500,000
Mauritius	2/35,400	520,000
Pakistan	27/111,500	210,000
Philippines	11/88,550	1,150,000
South Africa	3/87,000	990,000
Spain	1/11,400	26,000
Venezuela	3/30,200	205,000
	TOTAL: 279/2,391,810	14,448,000

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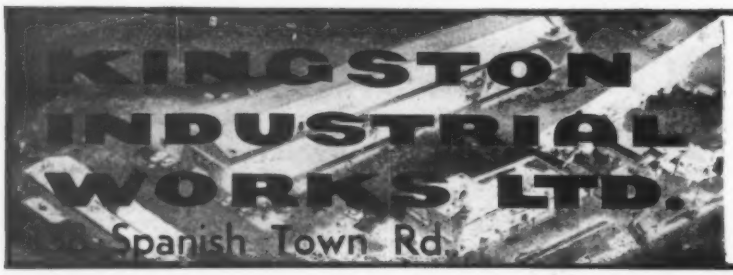

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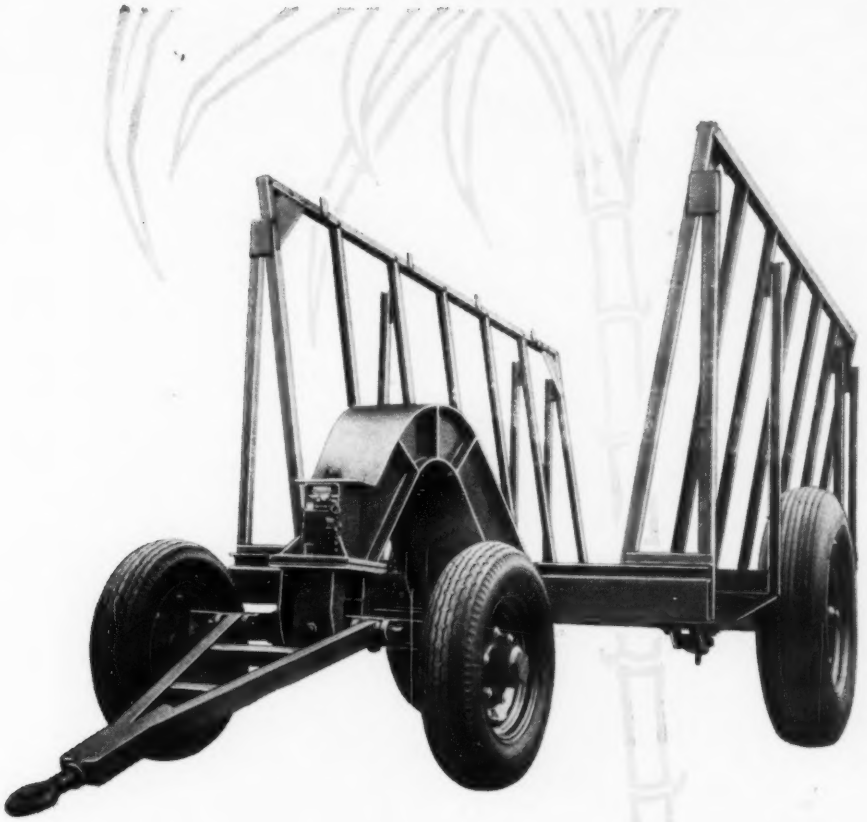

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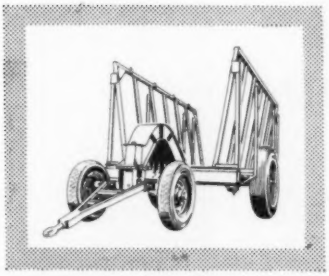

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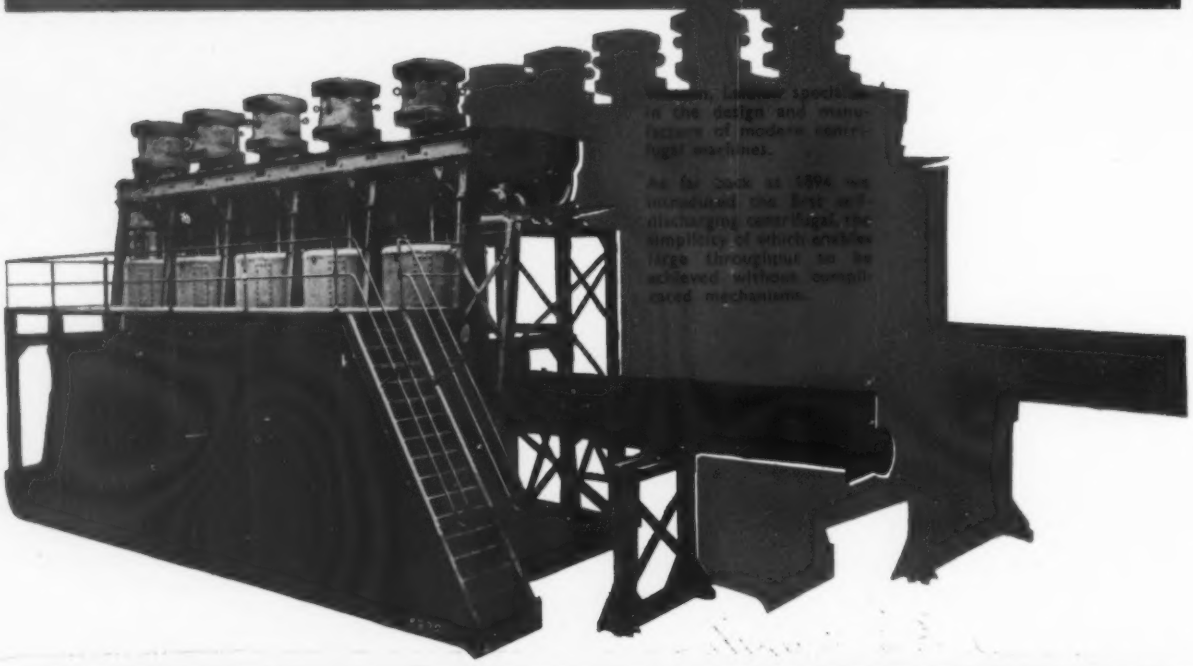

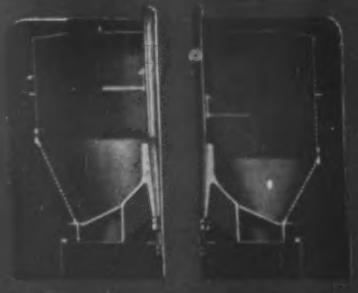

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII NOVEMBER, 1961 No. 755

NOTES AND COMMENTS

International Sugar Conference.

The International Conference which opened on the 12th September is still continuing, under the chairmanship of Dr. R. E. STEDMAN, Executive Director of the International Sugar Council. Up to the beginning of October it was reported that very considerable progress had been made and discussions on new members and greater flexibility in the handling of price and quota arrangements were said to be going well.

However, after more than four weeks of negotiations it seemed at mid-October that a state of deadlock had been reached. Following the announcement by President DORTICOS of Cuba, reported elsewhere in this issue, that the Communist countries had agreed to take at least 4,860,000 tons each year until 1965, Cuba is reported to have asked for a quota of no less than 7,285,000 tons, which compares with her present quota of 2,415,000 tons plus a tolerance of about 3,000,000 given in respect of her loss of U.S. outlets after the break between the two countries. It is understood that a continuance of this quota-plus-tolerance system would be acceptable to the majority of the countries attending the Conference but few are at present believed to be willing to change their views that the Cuban request is completely unacceptable.

The Conference is reported by C. Czarnikow Ltd.[1] to be continuing in the friendliest atmosphere, and "Conferences have a way of solving their difficulties at the eleventh hour, however, and it is to be hoped that an acceptable compromise is still possible . . . if the Agreement does not fail on this question of quotas it will be very important to see that the International Sugar Council is given adequate powers to limit the tonnage of sugar which can be marketed."

* * *

U.K. Sugar Board 1960/61 Report.

During the year ended 30th June 1961, the Surcharge remained constant at 1¾d per lb (refined basis) which was fixed in January 1959. World market prices ranged from 2·69 to 3·40 cents per lb f.a.s. Cuba (average 3·03 cents) compared with an average of 2·97 cents per lb in 1959/60.

The Board's net outgoings were £25½ million on the purchase (at the negotiated price) and resale (at world price) of 1½ million tons of Commonwealth sugar together with £15½ million in respect of the production of over 900,000 tons, raw value, by the British Sugar Corporation. Net receipts in respect of Surcharge collected during the year totalled nearly £41¾ million. A surplus of £320,000 remained after charging interest and expenses although there would have been a deficit if it had not been for the short-fall in the Mauritius quota shipments resulting from the 1960 cyclones. The accumulated under-recovery of £6·7 million is carried forward to the next accounting period, while the surcharge was increased from the 2nd August 1961 by ¼d per lb.[2]

* * *

European beet sugar production estimates.

Elsewhere in this issue we reprint the estimates of beet sugar production in Europe issued by F. O. Licht K.G.[3] for 1961/62 compared with the corresponding figures for 1960/61 and 1959/60. Last campaign was extraordinary with very much higher crops than normal so that it was to be expected that there would be a decline from the 22·5 million tons level in 1961/62. Licht, in fact, forecasts a fall of more than 10% to 20,182,800 tons which, however, is still 2·7 million tons more than the 1959/60 outturn. The 1961/62 forecast, while not surprising in itself, contains figures for individual countries which are of great interest. According to C. Czarnikow Ltd.[4], "the market will be interested in noting in due course how well final statistics, where published, bear out these initial estimates.

"It was generally anticipated that production in Western Germany and France would be some way below the records established last season but even so there were few who would have put the probable outturns quite so low as Licht has done, although it is pointed out that Government restrictions this season will limit the beet tonnage to be processed in

[1] *Sugar Review*, 1961, (529), 177.
[2] *I.S.J.*, 1961, **63**, 258.
[3] *International Sugar Rpt.*, 1961, **93**, (8), 125.
[4] *Sugar Review*, 1961, (529), 178.

France. Of the East European countries the crops in East Germany and Bulgaria are both put somewhat lower than might have been anticipated from the respective acreages, but the former country is known to have experienced economic and other difficulties recently whilst a drought lasting from early August to mid-September severely curtailed the development of the roots in the latter.

Despite an increase in the area, combined with good growing weather recently, the estimate of 180,000 tons in respect of Ireland appears rather high although such a quantity would certainly be of use to that country in her plan to become a net exporter.

It is the forecast of production in the Soviet Union which has excited most interest, although at 8·2 million tons it certainly bears out estimates made earlier this season by other authorities. It is believed in some quarters, however, that the Soviet Union, when making an assessment of production, takes the factory outturns, which figures include the manufacture of white sugar from imported raws. If this is in fact the case it would account for the need of the U.S.S.R. to make ever-increasing purchases of foreign sugar at a time when her domestic production appeared to be expanding year by year and would also account for some of the apparent anomalies in that country's published figures. Indeed, unless there is some such explanation the Soviet Union will, between her domestic supply of 8·2 million tons and her imports of three million tons from Cuba, mentioned elsewhere in these columns, have sufficient sugar available, even after allowing for her customary exports, to sustain a *per capita* consumption approaching that of the United Kingdom and in excess of the current rate of the United States. Her annual consumption in 1960, incidentally, according to the I.S.C.'s *Sugar Year Book*, was less than 30 kilos per head.

* * *

U.S. sugar quotas, 1962.

It was announced on the 21st September that 1962 quotas will be proposed in December of this year based on a requirement of 9,500,000 short tons, raw value, 200,000 tons less than the actual domestic offtake estimate. It has been thought desirable to limit supplies below the anticipated minimum needs to achieve prices which will "fairly and equitably maintain and protect the welfare of the domestic sugar industry." This results from the decline of sugar prices during July and August and the general weakness in prices for contracts for early-1962 deliveries. Quotas have been announced for the period January to June 1962, when the Sugar Act expires, the sugar and liquid sugar quotas for Cuba having been omitted from the 4,750,000 tons in accordance with Section 408(b). The quotas are given below.

The Cuban quota would have been 1,574,621 tons. No announcement of non-quota allocations has been made, and it has been suggested[1] that the Department of Agriculture might decide not to reallot the full Cuban quota at least until some indication of the 1962 price

Area and Country	*Quotas* (*short tons, raw value*)	*Direct-Consumption Limits* (*short tons, raw value*)
Domestic beet sugar	1,032,931	no limit
Mainland cane sugar	317,843	no limit
Hawaii	576,476	16,229
Puerto Rico	602,780	70,342
Virgin Islands	8,220	0
Philippines	490,000	29,960
Peru	49,928	5,114
Dominican Republic	43,204	4,560
Mexico	34,954	8,282
Nicaragua	7,300	5,461
Haiti	3,612	3,500
Netherlands	1,900	1,900
Taiwan	1,842	1,842
Panama	1,842	1,842
Costa Rica	1,837	1,837
Canada	316	316
United Kingdom	258	258
Belgium	91	91
British Guiana	42	42
Hong Kong	2	2
Total	3,175,378	151,578

LIQUID SUGAR QUOTAS

	Wine gallons 72% total Sugar content
Dominican Republic	415,447
British West Indies	150,000
Other Foreign Countries	0
Total	565,447

trend is known. Under the provisions of the Sugar Act, Haiti, the Netherlands, Taiwan, Panama and Costa Rica would receive allocations sufficient to bring their individual entitlements to 5000 tons, which would absorb 13,967 tons, while 15% of the balance (234,098 tons) would go to the Philippines. The remainder would be shared amongst other foreign countries *pro rata* to their quota tonnages. These are calculated by Czarnikow as follows:

	Short tons, raw value
Philippines	234,098
Peru	486,658
Dominican Republic	421,118
Mexico	340,704
Nicaragua	71,155
Haiti	1,388
Netherlands	3,100
Taiwan	3,158
Panama	3,158
Costa Rica	3,163
Canada	3,080
United Kingdom	2,515
Belgium	887
British Guiana/Hong Kong	439
	1,574,621

[1] C. Czarnikow Ltd., *Sugar Review*, 1961, (527), 169-170.

THE OVERHEAD IRRIGATION OF SUGAR CANE IN NATAL

By T. G. CLEASBY, Ph.D.

(Research Officer, Tongaat Sugar Company, Maidstone, Natal, South Africa.)

Paper presented to the "Africa and Irrigation" Syposium, Salisbury, Southern Rhodesia, August 1961.

PART I

THE sugar belt of Natal embraces a narrow coastal strip stretching from Port Shepstone (latitude 30° 75′ S), 80 miles south of Durban, into Northern Natal (latitude 27° 50′ S). With the exception of certain limited areas, cane is grown economically under dry land conditions. The yield is, however, dependent upon the rainfall which is always inadequate for maximum production. This is shown in Table I in which the mean yield for the industry has been tabulated against the rainfall for two consecutive years. The reason for this is that cane in Natal is a two year crop—in other words cane cut this year will not normally be ready for cutting again until 1963. As water is undoubtedly the major factor limiting cane growth, it is rather surprising at first to find that only 10% of the industry is under irrigation.

Table I

Correlation between Rainfall for two years ending 31st May, and Yield in tons cane per acre for Natal

Year	*2-year rainfall Inches*	*Mean yield t.c.a.*
1943	83	30.9
1944	87	29·1
1945	80	25·7
1946	68	22·0
1947	61	24·5
1948	73	26·8
1949	70	24·7
1950	70	26·4
1951	64	23·3
1952	62	26·3
1953	70	28·8
1954	73	32·5
1955	86	34·3
1956	86	31·3
1957	87	34·0
1958	99	39·0
1959	89	34·2
1960	69	35·8

One of the reasons for this is that increased production has been possible since the war, by bringing more land under cane, planting better varieties and the more intelligent use of fertilizers. There has, therefore, been no great incentive or need to develop irrigation. Another reason is that the land on which cane is grown in Natal is very undulating with many steep slopes which do not lend themselves to irrigation. The development of overhead irrigation in recent years has provided a method with technique and equipment much more suited to the terrain but the capital cost is high, so the area which can be brought under irrigation is again limited. A third reason for the slow development of irrigation is the source and supply of water. The majority of rivers and streams carry mainly flood water and in dry periods have a limited flow which is in great demand. For an extensive irrigation scheme, water has to be transported a considerable distance and lifted to irrigate the tops of hills; both these operations are expensive and result in power having a fundamental bearing on the economics of irrigation.

A minor reason why a greater area of cane has not been put under irrigation is a widely held view that the application of supplementary water might reduce the relatively high sucrose per cent cane. Experiments have shown that this is not necessarily the case if

AFRICA AND IRRIGATION

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One feature of the new plant is a lecture theatre equipped for still and cine film projection; and this exemplifies an important part of the Wright Rain approach—the education of the farmers who are users and potential users of their overhead irrigation equipment. To this end they have organized demonstrations and tours of sites where the latest techniques in irrigation, hydraulic distribution of manures, etc. are in operation, and they have held Symposia in 1956 *and* 1961 *which brought together people from many parts of the world having a common interest in irrigation.*

The second of these, under the title of "Africa and Irrigation," was held in Salisbury, Southern Rhodesia, and considerable numbers of papers were presented by experts in the field of irrigation, of which this article is one. Other papers of direct and indirect interest to the sugar industry will also be referred to in future issues, either in abstract form or at greater length.

Table II

Mean Meteorological Data for Sugar Belt of Natal

Month	Rainfall in	Evaporation in	Temperature Max. °F	Temperature Min. °F	Temperature Soil 1′ °F	Humidity % 8 a.m.	Humidity % 2 p.m.	Daylight hours
January	4·15	5·6	81·0	67·2	78·7	75·7	67·3	187·4
February	4·76	4·8	81·6	67·7	79·5	78·3	68·9	183·1
March	5·26	4·4	80·3	66·0	78·1	80·4	68·7	199·8
April	2·66	3·4	78·3	62·2	74·9	79·9	66·2	208·8
May	2·12	2·8	75·9	57·1	69·4	74·1	60·0	221·2
June	1·45	2·4	72·9	52·6	64·1	68·8	54·0	217·0
July	1·07	2·6	72·5	51·9	62·7	69·3	47·0	226·0
August	1·40	2·9	73·2	53·9	64·5	72·7	58·1	218·2
September	2·59	3·6	74·3	57·2	67·6	72·0	61·5	190·6
October	3·54	4·1	75·8	60·9	70·7	72·9	66·0	171·0
November	4·23	4·8	77·7	63·4	73·5	72·8	67·5	164·7
December	4·70	5·4	80·0	65·7	76·4	73·6	67·8	176·2
Total or Mean	37·93	46·8	77·0	60·5	71·7			

NOTE.—The rainfall is the mean for the industry, but all the other figures have been recorded at the Experiment Station, Mount Edgecombe.

controlled drying off is practised; there is some evidence to suggest that irrigation can increase the sucrose content of the cane.

Without arguing the case of overhead *versus* surface irrigation in detail, three factors favour the use of the former method. These are the terrain, the limited amount of water available for irrigation during dry periods, and lower labour requirement. Once a decision has been taken to irrigate, these advantages should outweigh the higher capital cost of installation. One estate, however, does irrigate over 12,000 acres of hilly land by surface methods but these schemes have been in operation for many years and the availability of water is not a limiting factor.

In Table II, some meteorological data has been recorded to help the reader to appreciate the most important climatic factors in Natal. The main growing period is from November to March when the temperature is high and the rainfall well distributed. A relatively cold and dry winter limits cane growth from June to September. During this period the cane normally suffers severely from drought and even in the presence of adequate water, the growth is very slow owing to the temperature. From an agricultural point of view, Natal's climate is a fickle mistress who frowns more often than she smiles. Floods and droughts have occurred in every month of the year, and two dry years together can reduce a crop by a much as 30–40%.

During the last seven years The Tongaat Sugar Co. Ltd. and Illovo Estates have put extensive areas under overhead irrigation and, in conjunction with the South African Sugar Experiment Station, have started to investigate the many problems associated with it. The nature of these schemes will be described in this paper, together with the results of some of the experimental work carried out at Tongaat and Illovo.

The original concept of irrigation was the application of water during the dry winter months, to keep the cane in a drought-free condition for growth with the spring rains and higher temperatures. Experiments and field practice have demonstrated the value of controlled irrigation the year round, to insure against droughts at any time and to produce the maximum economical growth. Unfortunately, at the present time the industry is over-producing cane to the extent that a quota system has had to be introduced. Under these conditions the place of irrigation is much more difficult to determine and tied up with factors outside the scope of this paper, which will only deal with irrigation in its own right.

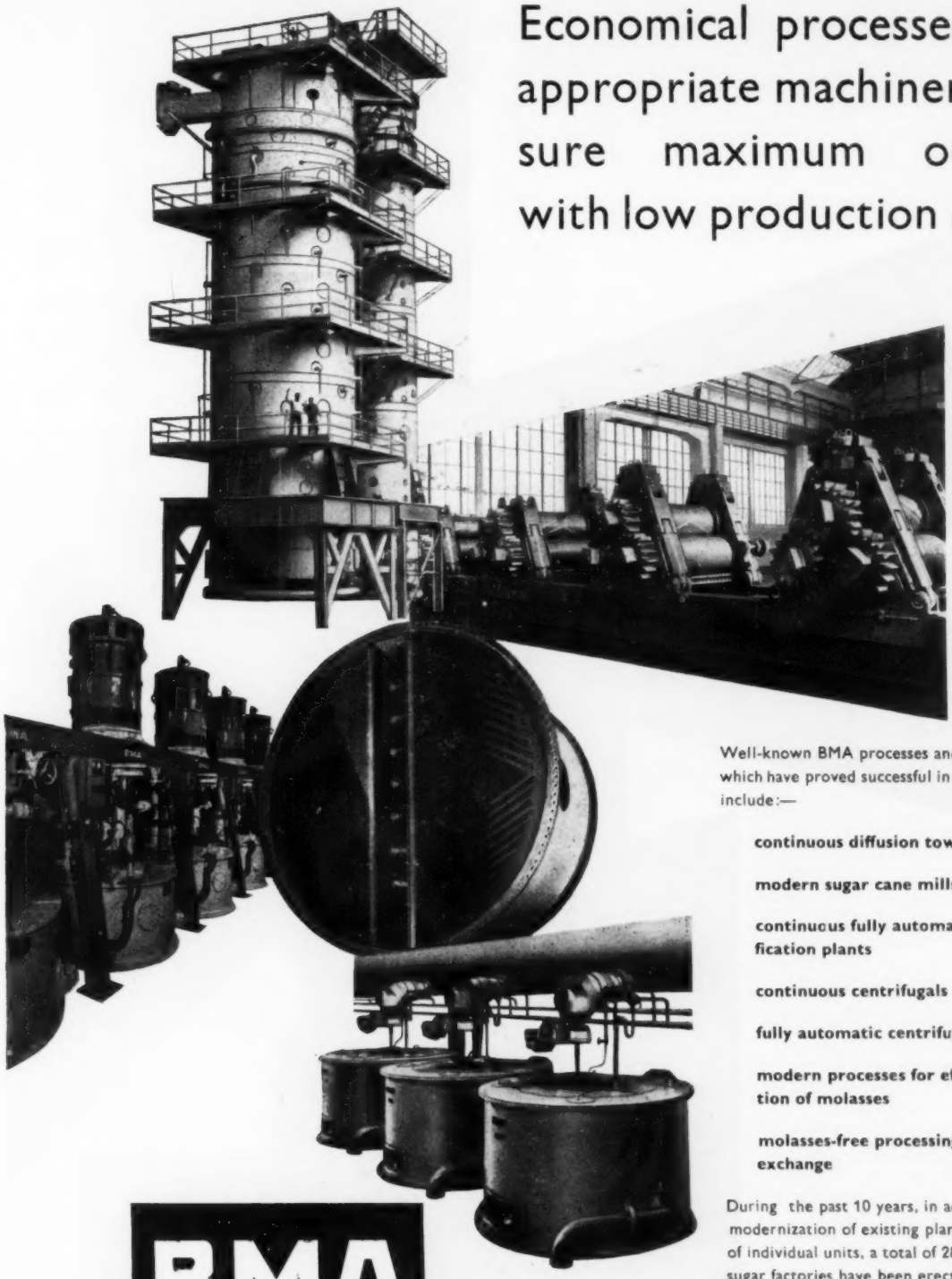
At Tongaat nearly 4,500 acres of cane are under overhead irrigation and 1463 acres have been brought under irrigation by Illovo Estates. The area at Tongaat is made up of five independent schemes referred to as Village Scheme (280 acres), Nollsworth Scheme (825 acres), Muckleneuk Scheme (1010 acres),

Table III

Summary of Irrigation Schemes in Operation at Tongaat

Scheme	Type	Area	No. Rainers	Available Water	Duty of Water (acres/cusec) 100% eff.	Duty of Water (acres/cusec) 75% eff.
Village	High pressure	280	2	1 cusec	280	373
*Nollsworth	High pressure	825	9	4 ,,	225	300
*Muckleneuk	High pressure	1,010	10	4 ,,	276	367
†Aberfoyle	High pressure	1,802	13	5 ,,	360	480
Effluent Scheme	Low pressure	350	3½ sets	1½ ,,	233	310
Mwawine	High pressure	100	1	½ ,,	200	267
Tongaat	Low pressure	100	1 set	½ ,,	200	267

* water available for 22 hours per day. † 300 acres of this scheme are irrigated with small low pressure rainers.



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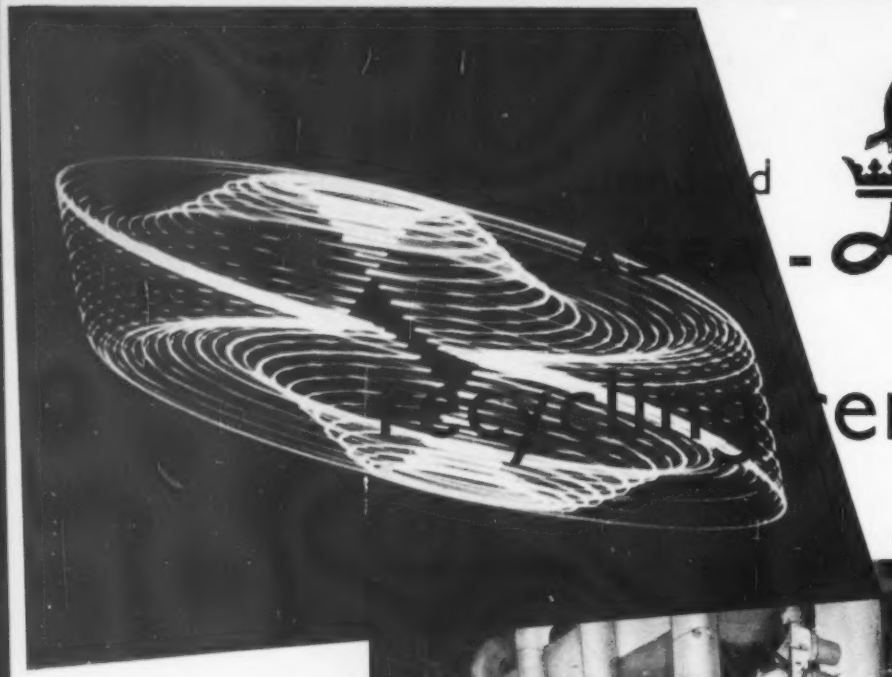

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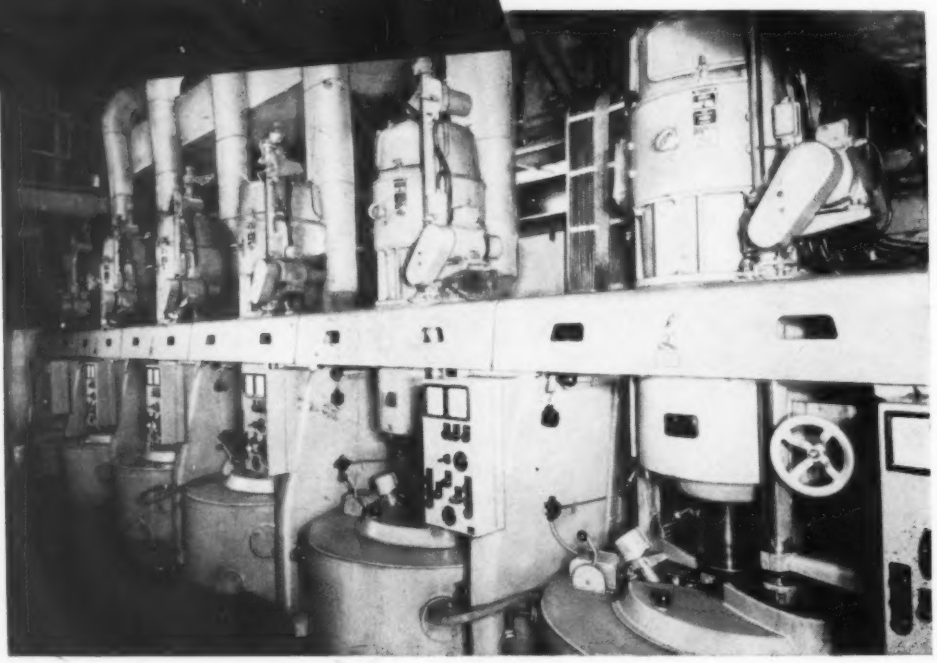

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Table IV

Irrigation Running Costs

"Break-Even" Tonnages Required to offset the Application of Certain amounts of Water

Water applied over average crop of 18 months	4 in	6 in	8 in	10 in	12 in	14 in	16 in	18 in	24 in	30 in
"Break-even" tonnage per acre required	5·0	5·6	6·3	7·0	7·8	8·5	9·0	9·5	11·4	13·0

Aberfoyle Scheme (1802 acres) and a factory effluent disposal scheme (350 acres). The first three schemes take water from the Umhloti River, while Aberfoyle is supplied with surplus water from the factory. The effluent scheme is designed to dispose of dirty waste water from the factory and when the factory is working it must continue to irrigate, whatever the rainfall or moisture status of the soil. It employs low pressure rainers which will be described later in this paper.

The three major schemes employ high level dams as peculiar primary pumping arrangements exist in each case, which make it profitable to pump to a high point and irrigate the maximum area possible by gravity. For Nollsworth and Muckleneuk schemes water is pumped from the Umhloti River jointly with a neighbouring company which requires water for surface irrigation, and for Aberfoyle water is pumped from the factory, using surplus power which has been paid for on a maximum demand basis. When the factory is not working from December to May, irrigation is restricted on this scheme by the amount of power available.

Further details of these schemes have been summarized in Table III. The duty of water employed is high but it can be justified on theoretical grounds as will be explained later. Furthermore, with sugar cane the entire scheme rarely requires irrigation at one time as some land is always either being dried off, harvested, ratooned under a trash blanket or prepared for replanting.

A description of the Nollsworth Scheme will explain the layout and the equipment employed at Tongaat for the high pressure schemes. It is based on four cusecs of water available for 22 hours a day from the Umhloti River. This is pumped by electrical power into a dam 400 ft above the river and holding approximately 3,000,000 gallons. From this dam 259 acres are irrigated by gravity and 556 acres require further boosting from the dam by two electrically driven motors of 70 and 90 horse power.

The scheme was originally designed to spray during the day and night, but night irrigation has been found difficult to control and is more expensive on labour, so it is only resorted to in cases of emergency. The major portion of the available water can be distributed under normal circumstances during the hours of daylight. Thompson at Illovo has introduced field radio telephones and pressure recorders to control the application of water during the day and night and this, though expensive, has been most successful.

Water is distributed from the dam through buried asbestos-cement laterals which vary in size from 8 to 4 inches. Portable 4-inch aluminium pipes connect the rainers to valves on these laterals at intervals of 160–180 feet. The scheme is designed to operate 9 rainers, each spraying 260 gallons per minute at a nozzle pressure of 70–85 lb per square inch. Bauer 33 and Rainbird 100b and 90 models are used giving an effective precipitation of approximately 1 inch per hour. The minimum operating pressure for these rainers appears to be low, but it is only obtained on certain high points and, at the time of construction, it was felt that heavier pumping units were not justified to satisfy limited areas.

The rainers at Nollsworth stand in fixed concrete positions, 160 feet, or 8 portable pipes apart, in a diamond pattern. This allows about 20% overlap. Although wind is often a problem, no circular patterns have been observed at this spacing, probably owing to the fact that irrigation is supplementary and surface run-off sometimes helps to fill in the overlap. Each rainer irrigates 90–100 acres and is controlled by one African or Indian irrigator during the day and two at night. A non-European sirdar or induna supervises the whole scheme and is responsible to a European irrigation overseer. Each operator has a full complement of portable aluminium pipes and two rainers and stand pipes to minimize the time wasted in changing positions. A bonus is paid to encourage each irrigator to irrigate as many positions as is possible in a 12-hour shift with the minimum delay in changing time. It also encourages them to look after their equipment.

The capital cost involved in installing a scheme similar to the Nollsworth one, worked out in 1956–57 to approximately £60–70 per acre; the cost of the primary pumping unit, rising main and the dam accounting for £20 per acre and the reticulation which includes the buried mains, booster pumps and spray equipment for £40–£50 per acre.

The actual cost of irrigating is more difficult to establish although a rough indication is given in Table IV where the increased tonnage of cane to offset the cost of applying water has been set out. The cane has been credited at £2 2s 0d per ton, assuming an average sucrose of 13·5%, and 10s deducted for cutting and transporting it to the factory. Pumping costs represent 2·4d per 1000 gallons to get the water into the dam and 3d per 1000 gallons for boosting. Depreciation has been spread over 20 years and allowances made for labour and maintenance costs, but not for supervision and management.

(To be continued)

A SURVEY OF CANE AGRICULTURE

10th Congress, International Society of Sugar Cane Technologists, 1959.

THE appearance of the Proceedings of the 10th International Congress held in Hawaii in 1959, permits a survey which must necessarily be considered in view of the number of papers presented.

Agriculture

The value of an aerial survey followed by the preparation of estate maps was discussed by B. E. BEATER who also gave a specification of 2-handled soil samples. A similar value was found by F. T. TABAYOYONG in a survey of the soils of the Victorias Milling District, and the linked variety and fertilizer adjustments are noted.

The effect of N on stalk population and, ultimately, yield under Hawaiian conditions of long growth were shown by T. TANIMOTO and G. BURR to depend more on amounts than timing. Through relative proportions of primaries and secondaries, the same yields (up to 20 tons sugar per acre) may be obtained by different routes. The use of liquid anhydrous ammonia and ammonium-nitrate-ammonia solution in Taiwan was described by S. E. WANG and K. L. LI, together with the system of transport.

D. H. PARISH and S. M. FEILLAFÉ concluded from studies in foliar diagnosis that, in Mauritius, the phosphate status of the soil has, broadly speaking, been built up by heavy dressings in the past but that recently the position has worsened owing to the heavier yields. Soil analyses are used by A. S. AYRES in Hawaii to determine a critical level for P, and analysis of 8–10 internodes by C. E. HARTT. The value of liming on the highly leached soils of Taiwan was reviewed by S. C. WANG *et al.*

Plant analysis in its various aspects was discussed in a series of papers. Various methods have been adopted in different countries and their relative merits were compared by G. SAMUELS who, in a second paper, drew attention to the influence of age on nutrient requirement. Mauritius has been in the forefront of leaf analysis, and the results in the case of N were set forth by P. HALAIS. For determinations of K adequacy R. F. INNES prefers leaf lamina, as questions of storage do not arise. In South Africa, both leaf and soil analyses are used and J. L. DU TOIT gave notes on the large increases in yield since 1951 from the more general use of fertilizers, particularly N and K, combined with favourable rainfall.

H. EVANS brought together, in an informative paper, the available information on the significance of elements other than N, P and K in cane growth. He relies on tissue analysis and has shown the wide variations which occur in different parts of the stalk. The most recent developments in crop-logging formed the subject of a paper by H. F. CLEMENTS.

An entirely different approach to cane growth was made by A. DE SORNAY and O. DAVIDSON. They worked out a stalk sampling method giving a correlation between stalk growth and yield, not the least value of which lay in the provision of a measure of cyclonic damage.

The long series of experiments with trash, bagasse and green manuring conducted on a range of soil types and described by L. P. HEBERT and L. G. DAVIDSON showed no consistent effect on the level of soil organic matter. C. H. O. PEARSON, discussing the Natal practice of trash conservation between the rows, compared the system to the natural conservation of the bush; i.e., the rotting of the first (plant) layer under the second (1st ratoon) layer.

Work on the determination by lysimeters of moisture requirements for optimum growth and for preparing an irrigation schedule, was outlined by R. B. CAMPBELL *et al.* R. K. ROGERS, illustrating the subject with ammonia distribution when applied in the irrigation water, showed how uneven the distribution is under surface irrigation. Experience with overhead irrigation on the Tongaat Estate, Natal, was explained by T. G. CLEASBY, and a brief note on a similar system on a 4000-acre estate in Mexico by A. MACARI and A. L. FORS.

The development and present status of weed control in Hawaii was described by N. S. HANSON. In the case of *Cynodon dactylon* and *Commelina diffusa*, tolerant strains have arisen and there is need for new types. The technique used in Mauritius to evaluate weed population, mortality and cane damage from the use of herbicide was noted by E. ROCHECOUSTE and two brief contributions were made by E. R. STAMPER and S. J. P. CHILTON on the use of "Silvex" (2,4,5,-T-P) and on the control of Johnson grass in stubble cane.

The urge to mechanization is, perhaps, greater in Hawaii than elsewhere and the problems are intensified by the length of the growing period. These problems, now involving the testing of 28 machines, were reviewed by R. A. DUNCAN.

In three further papers, A. W. TURNER showed a relationship between losses in cut cane left in the field and cane age; R. E. COLEMAN *et al.* conclude that none of the responses to gibberellic acid have practical value. D. T. TAKAHASHI gave an interesting account of tagged N applied to roots and at points of the stem in determining N translocation and the early stages of protein synthesis.

Breeding

A general discussion of the principles involved in the breeding of vegetatively propagated plants was made by G. W. BURTON and illustrated by examples drawn from Bermuda grass (*Cynodon dactylon*) and Napier grass (*Pennisetum purpureum*). The climatic conditions at Taliparamba, S. India, where a world

collection of canes is maintained, are compared with those at Coimbatore by A. S. ETHIRAJAN and found to be more favourable to arrowing.

The actual techniques of breeding vary somewhat from country to country and some of these formed the subject of papers. The Queensland technique was briefly described by J. H. BUZACOTT, and that adopted in U.S.A., where little success has been obtained with inbreeding, by A. J. MANGELSDORF. P. GONZÁLEZ-RÍOS' account of methods adopted in Puerto Rico deals only briefly with the technique adapted to the conditions of heavy rainfall and is mainly concerned with the parental combinations used and with seedling raising and selection.

Corn (maize) is the crop in which inbreeding has had great success and this method was compared with recurrent selection by G. F. SPRAGUE. The application of inbreeding to sugar cane has been extensively adopted in Barbados by G. C. STEVENSON who emphasized among other points, such as self-sterility and male fertility, that vigour is by no means always lacking. The experience of the Colonial Sugar Refining Company in this matter was given by J. DANIELS while, in the case of *S. spontaneum*, no loss of vigour through inbreeding has been found by R. R. PANJE and H. S. ETHIRAJAN.

Experience in bunch planting in Queensland was given by J. C. SKINNER and, in Louisiana, by L. P. HEBERT and B. S. NEWTON. The experiments are in their early stages but offer promise. The major advantage is economy of land combined with a higher percentage of selected plants. Subsequent selection methods as practised in Hawaii were described by R. URATA and J. N. WARNER, and those adopted in Java by G. A. W. WAGENAAR. Early selection, in the latter case, is based on visual tests—largely concerned with disease—and juice quality.

In ascertaining the environmental effects as influencing the selection of seedlings among populations of like origin, E. F. GEORGE, of Mauritius, found the mean progeny length a useful criterion. The use of the hand refractometer in selection was discussed by L. P. HEBERT. Factual evidence as to the border effects in small plots was adduced by L. M. WEETMAN and B. W. HUNDERTMARK. The application of statistical methods for the selection and evaluation of sugar cane was discussed by J. G. DARROCH. The argument centred on plot size and relative harvesting cost.

Papers primarily concerned with the commercial aspect of seedling canes include one by L. P. HEBERT and R. J. MATHERNE which deals mainly with the yield trends of these under the differing environmental conditions found in Louisiana. A second, by A. L. FORS, reviewed the position in Cuba; a similar system for Taiwan was given by C. S. LOH.

Behind all this work for the procuring of varieties, whether improved or to replace those "running out," lies the need for extending the genetical range of material available for crossing. New Guinea has long been a rich source and, according to J. N. WARNER and C. O. GRASSL, this source is far from exhausted. F. M. VEIGA gave a brief review of the intergeneric crosses with particular reference to the "Cana Uba" (*Gynerium spp*) of Brazil. An account of the evidence of gene mutation and of the possibility of making practical use of such, was given by S. PRICE and J. N. WARNER, and R. R. PANJE and P. R. PRASAD described experiments with ionizing radiations on vegetative tissues, the results of which so far, however, suggest no practical application.

Flowering and the methods of its control formed the basis of several papers. The effects of controlled day-light, irradiation, shading and treatment with chemicals was broadly described by R. E. COLEMAN, while J. T. RAO and R. K. KUMARI showed that photoperiodic alterations may affect pollen fertility. The effect of environment of the varietal forms of *S. spontaneum* collected at Coimbatore was explained by R. R. PANJE and K. SRINIVASAN. Frequent irrigation was found by P. E. RÖHRIG *et al.* to increase flowering in certain varieties, and this was intensified by "misting" (spraying with a fine jet) with the plot enclosed in polythene, thus maintaining atmospheric humidity.

Among the papers dealing with subsidiary problems are included the following: fluctuation in starch content in certain *Saccharum* and *Erianthus* species by K. C. RAO and K. V. G. AIYER, composition of cane juices in new Co canes in relation to jaggery manufacture by K. V. G. AIYER and K. C. RAO, epidermal patterns and their relation to chromosome numbers in *S. spontaneum* by C. N. BABU and varietal differences in damage by grasshopper by R. A. AGARWAL and P. A. KANDASWAMY.

Entomology

The Cuban economy is dependent on sugar and though it has only one serious pest, *Diatraea saccharalis*, the position is carefully watched. L. C. SCARAMUZZA gave a list of insect and animal pests with the hyper-parasites of the former. A very interesting account of the entomological changes in Hawaii between 1930 and 1959 was contributed by F. A. BIANCHI, in which the causes of the sporadic outbreaks which have occurred from time to time were traced. A list of injurious and beneficial insects as they occur in Venezuela was given by P. GUAGLIUMI.

The major universal pests of the sugar cane are the borers, of which there are several species. The extent of the damage caused by *D. saccharalis* as affecting the available sucrose in the mill was investigated by T. G. ELLIS *et al.* who concluded that a unit weight of cane was a better basis for measuring the loss of sucrose than % of bored joints. A review of work in Louisiana on borer damage, based on % infected joints, was given by R. MATHES *et al.* On a wider basis, including biological control, the position in certain of the West Indian islands was presented by H. E. BOX who also contributed a list

of *Diatraea* and allied genera found in the Western Hemisphere. D. D. QUESTEL and T. BREGGER measured the internal temperatures of the stalks and found that only in fields yielding 40 tons/acre cane is sufficient heat developed to kill borer larvae within the cane.

A series of papers dealt with the methods of biological control as practiced in different countries. Louisiana practice was described by L. J. CHARPENTIER *et al.*, by L. C. SCARAMUZZA for Cuba, by F. J. SIMMONDS for Guadeloupe, by S. H. RISCO for Peru and by B. D. GUPTA and P. N. AVASTHY for India, where the borer is *Chilo tumidicostalis*. Success with the introduction of *Lixophaga* to Taiwan, where five species of borer cause damage, was reported by C. B. CHEN and T. H. HUNG. Chemical control was illustrated by W. H. LONG who gave a brief history of the use of insecticides in Louisiana. Used in granular form 2% "Endrin" gave good control, followed in effectiveness by "Thiodan."

Five species of white grubs cause damage in Australia. The tests with insecticides, in which BHC was predominant, were described by G. WILSON. The ecological status of mealy bugs, of which there are five species in Hawaii, was reviewed by J. W. BEARDSLEY. Field control has not been attempted. Stalk weevils do damage locally in Mexico; the taxonomy and biology of the six species of *Cholus*, of which *C. morio* is the most important, were described by S. FLORES and A. GONZALEZ. B. D. GUPTA detailed at some length the methods used throughout India for the control of termites.

Rats are a common pest and are, with insects, members of the animal kingdom; it is useful, however, if erroneous, to class them under the term Entomology. The methods of rat control in Hawaii were outlined by F. A. BIANCHI. He places the main problem as one for the local plantation. Some $300,000 are being spent yearly; but the major difficulty lies in the cost of labour, and the possibilities of distributing bait by aircraft requires investigation. The position in Louisiana was described by J. W. DOTY. Here trash burning is held to be the major check on the rat population.

Pathology

Behind the question of the control of disease, and the same applies to pests, lies the problem of keeping out those which have not yet gained an entry into the particular country. The methods adopted form the quarantine system, the importance of which, particularly in the matter of pests, has grown with the increasing use of the aeroplane; the major source, in the matter of disease, is the importation of plant material, the interchange of varieties, which is so marked a feature of the sugar cane industry. Quarantine, as practised in different countries, formed the basis of several papers and, in this matter, the quarantine systems of Hawaii and Mauritius are of particular interest since both are isolated from the nearest land masses from which natural immigration, particularly of pests, is likely to occur. The pathological aspects of quarantine in the former were briefly described by J. P. MARTIN and in the latter by P. O. WIEHE. Descriptions for other countries were given by E. G. BABER and P. B. HUTCHINSON (New South Wales), H. T. CHU (Taiwan), G. M. REYES (Philippines), E. E. ANDERSSEN (South Africa), M. H. BARAT (Madagascar) and I. E. STOKES *et al.* (U.S.A.).

Among the diseases to assume importance in recent years is ratoon stunting disease and here, again, a series of papers was devoted to its consideration. H. T. CHU *et al.* described the methods of control in Taiwan and the effectiveness of control as obtained in different varieties in Louisiana by R. J. STEIB and I. L. FORBES; hot water treatment, with germination figures as obtained at San Cristobal, Mexico, were given by F. SÁNCHEZ NAVARRETE. Certain precautions in using a test plant, involving choice of variety, for determination of the presence of the disease through coloration of immature nodes, were outlined by C. A. SCHEXNAYDER, and lignification of the phloem, another symptom, by E. ARTSCHWAGER. R. ANTOINE noted on the histo-chemical test developed by him involving the use of colourless 2,3,5-triphenyl tetrazolium chloride which is converted into red formazan more rapidly in virus-infected viable material; with some varieties the test has given inconsistent results.

A single paper appeared in the following diseases: mosaic, the recovery of seedlings being noted by Y. E. AZAB *et al.*, based on Louisiana experience, Fiji disease, the reaction of infected plants to gibberellin being recorded by G. O. OCFEMIA and F. L. NUQUE who found none except the normal one of increased growth; chlorotic streak, R. ANTOINE giving evidence that the disease is soil-transmitted; red rot, Y. E. AZAB and S. J. P. CHILTON finding no correlation between parental resistance and that of the offspring seedling; downy mildew, LII-SIN LEU and TEH-LING CHU describing the transmission of the disease from maize to cane; and pythium, C. A. WISMER finding that the Bayer product B 22555 conferred protection through some systemic action.

A new disease, termed false smut, has appeared in Queensland and was described by P. E. ROBINSON; it seems to be an association of the two fungi, *Claviceps purpurea* and *Cerebella andropogonensis*, the life histories of which are noted. Two diseases, previously unrecorded in Hawaii and termed leaf stipple and ring mosaic respectively, were linked by J. P. MARTIN and C. A. WISMER with two similar diseases earlier reported from Java.

A detailed list of sugar cane diseases and their world distribution, prepared by the Standing Committee, I.S.S.C.T., is included.

H. M.-L.

Guatemala sugar crop, 1960/61.[1]—The sugar crop in Guatemala yielded 87,400 tons in 1960/61, an increase of 15,800 over the previous season's production. It is estimated that the yield next season will be in the region of 100,000 tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1961, (523), 154.

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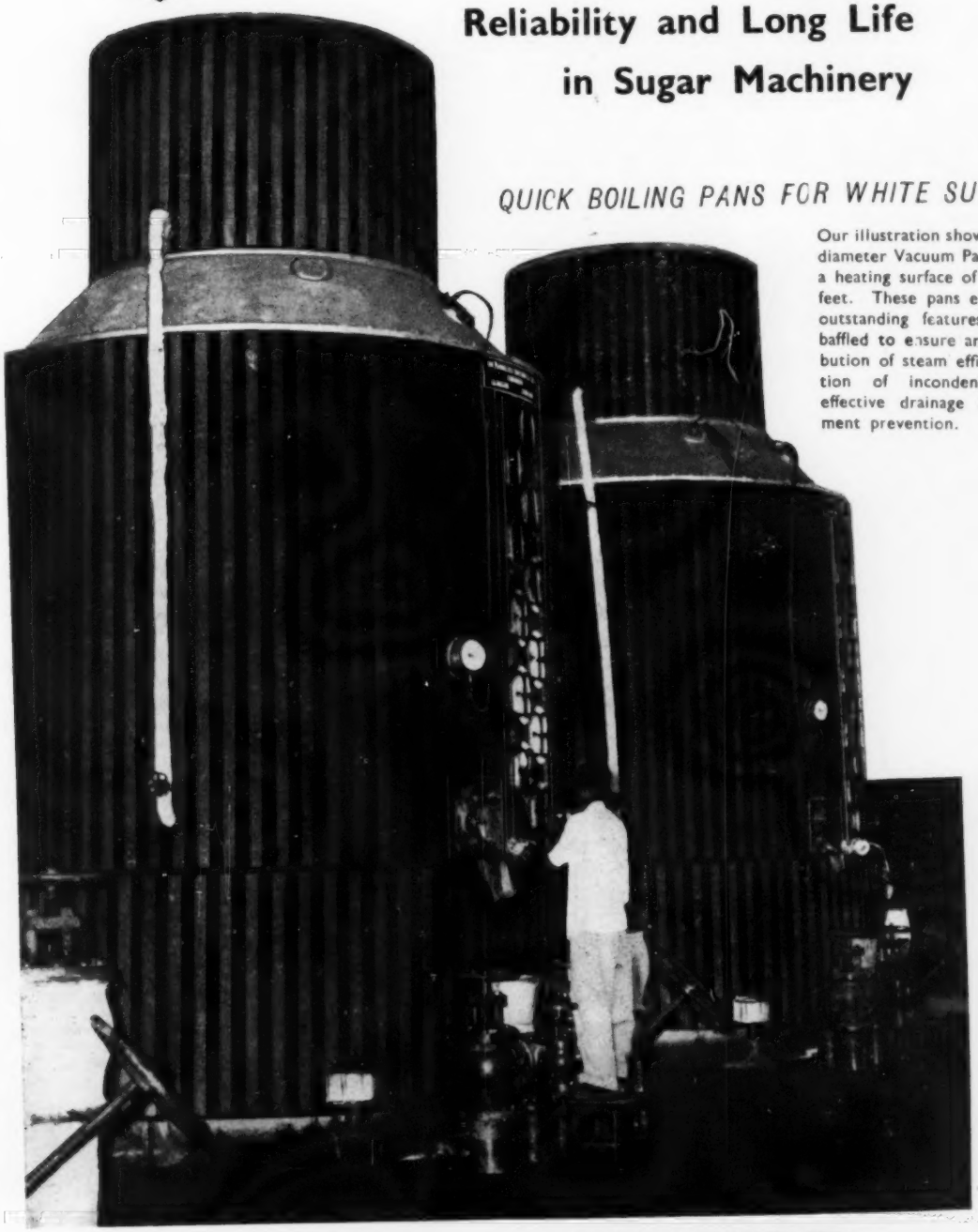

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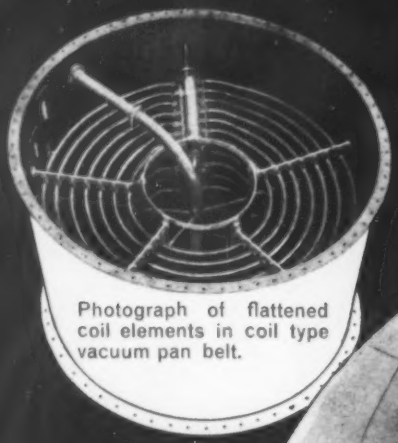
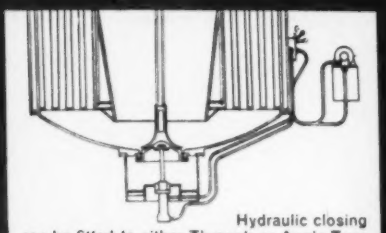


Photograph of flattened coil elements in coil type vacuum pan belt.



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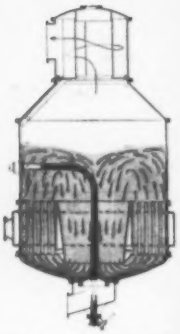

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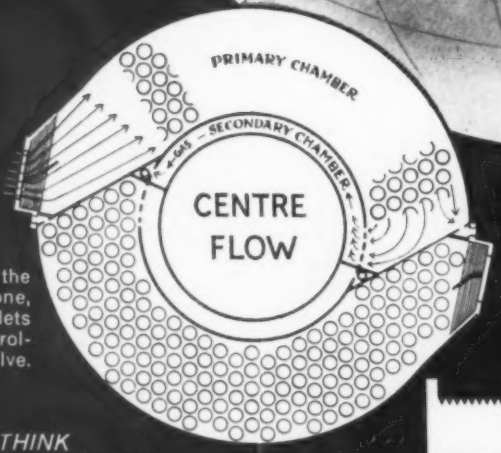

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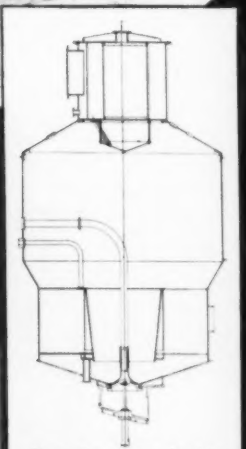

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P6536

THE SUGAR CANE IN HAWAII

1960 Report, Experiment Station, Hawaiian Sugar Planters' Association

Cultural Practices

THE title of the leading section of the Report is, perhaps, somewhat misleading, for it deals with those fundamental problems of plant physiology and the plants' relationship with its environment on which a vigorous and healthy growth depends. The less complex studies cover the response to sulphur, an element deficient in some Hawaiian soils, the extent of leaching as indicated by lysimeters, liming and the interaction of Ca and K leading to K conservation, the influence of soil temperature on leaching, photo-synthesis and plant growth, juice quality in relation to moisture stress, and varietal growth characteristics as determined on single-eye plantings. The more complex studies include the use of tagged elements, ^{45}Ca, ^{15}N and ^{14}C, to trace the movement of these elements in the plant tissues and, in particular, the mode of synthesis of sucrose and its translocation from the leaf to the apical meristematic tissues, its distribution in the plant and its storage.

Field Operations

These are reported under the headings irrigation, mechanization and tillage.

Irrigation. Here, again, is seen concentration on fundamental problems through the use of lysimeter evapotranspiration determinations and gypsum blocks with the ultimate objective of ascertaining the optimum irrigation interval whether for flow or overhead irrigation. Ecological conditions vary widely and rapidly between localities leading to varying local irrigation requirements, and 13 new evaporation stations have been established to supply more detailed information.

Mechanization. A description is given of the prototype HSPA seed cane harvester with the recent modifications made. A reduction in eye damage is desirable as also of trash, the respective figures as compared with hand-cut cane being: eye damage, hand-cut 3·05%; machine-cut 11·02%; trash, hand-cut 0·6%, machine-cut 4·6%. Two further new seed cane harvesters are also described as well as two cutting and loading harvesters termed respectively cut-convey-load and cut-throw-load. Several other lines of investigation connected with other aspects of harvesting and transportation are touched upon including adaptations of the Martin-Dicker hydraulic remote reading scale for weighing experimental cane, a comparison of wheeled and track trucks and a cane core-sampler for sampling trucks loads. The section concludes with a financial analysis of harvesting costs on the Hilo-Hamukua Coast.

Tillage. The effects of compaction, due to harvesting operations, on the subsequent crop are noted. Tillage is further discussed from the two aspects of securing deep rooting and of facilitating land preparation. Modifications and design of the mouldboard plough are also discussed.

Varieties

The number of crosses made amounted to 4,936 and the seedling testing programme is very briefly tabulated. Flower induction by chemical spray and light control is also briefly discussed. Heavy rain as soon as 2 hours after spraying CMU does not materially affect the treatment. Of the chemicals tested only DCMU and CMU gave satisfactory control. Marcotted plants of 37–1933, exposed for 60 days to 12·5 hours light at 70°–80°F, flowered two months early.

Pythium graminicolum rot is considered to be the major disease responsible for diminishing commercial returns, exposing the roots to other soil organisms such as nematodes. For the present, the use of new varieties is held to offer the only practical solution.

Diseases

The differential varietal resistance to Fiji disease and downy mildew, as indicated by the trials jointly undertaken by the H.S.P.A. and the C.S.R. in Fiji, are set forth in tabular form. Varietal tests are being conducted for ratoon stunting disease, red rot, *Pythium* and nematodes. A preliminary test of chemicals and fumigation for control of the last two is also noted. Both top and root development of 32-8560 by fumigation, through injection, were greatly stimulated. Application rates were: DD 40 gal/acre, "Bronzone" 300 and 200 lb/acre and "Trizone" 200 and 140 lb/acre; with the two latter treatments polyethylene covers were immediately applied.

Pests

Insect pests are well under control and brief notes are given in the cases of *Anomala*, the borer *Rhabdoscelus* and army worms. The major pest is the rat, both black and Alexandrin. A search is being made for new baits. Tracking rats is being attempted by the addition of dyes, of which "Sudan Black B" proved far the superior, to the bait, thereby enabling their daily and seasonal movements to be traced.

Weed Control

Screening of new herbicides has received much attention and their mode of activity is described. A differential varietal damage was found. A differential response was also found in strains of Bermuda grass (*Cynodon*). Novel types of equipment are noted and a wind tunnel has been installed to study spray drift.

H. M.-L.

The sugar cane borer: how to control it. *U.S. Dept. Agric. Leafl.* 1960, (479), 1–8; through *Hort. Abs.*, 1961, **31**, 427.—Cultural practices recommended to reduce *Diatraea saccharalis* infestation include the selection of resistant varieties and borer-free planting material, breaking old fields in autumn or early spring, harvesting infested cane as early as possible, cutting cane close to the ground, burning all trash, and shaving infested summer- or autumn-planted cane in the winter and burning the plants. The insecticide recommended is 2% granular "Endrin" applied 4 times at 12 lb per acre at 14-day intervals ending at least 45 days before harvest.

* * *

A manurial trial on sugar. R. T. CLARKE. *East African Agricultural and Forestry J.*, 1961, **26**, 184–186.—The results of a trial comparing four applications of sulphate of ammonia, each applied by two methods at two times, are given, and a comparison of the efficiencies of two alternative forms of analysis is made. With the first ratoon crop an application of 3 cwt per acre increased yield of cane from 41·3 tons to 51·3 tons per acre. No further increases in yield resulted from 6 and 9 cwt applications.

* * *

Growing sugar cane for forage. T. BREGGER and R. W. KIDDER. *Univ. of Florida Agric. Expt. Sta.* (Gainesville) *Circ.* S–117, 1959, 1–12.—In southern Florida sugar cane gives high yields of excellent cattle fodder and a higher total of digestible nutrients per acre than any other crop available, the harvesting season coinciding with the winter months when perennial pastures grow slowly. Details are given of the best cultural practices, including choice of variety for the use of the crop as fodder. It is pointed out that the development of a satisfactory mechanical method of handling the crop would greatly increase its value.

* * *

Chlorotic streak and confirmation of its presence in Cuba. L. C. SCARAMUZZA. *Bol. Ofic. A.T.A.C.*, 1961, **20**, 25–27.—The presence of the disease in Cuba is briefly noted with observations on its transmission and control.

* * *

A new high-yielding variety. ANON. *Bol. Ofic. A.T.A.C.*, 1961, **20**, 28–29.—The variety briefly described is Puerto Rico 1013, a cross Co 281 × POJ 2878.

* * *

The missing link. M. R. BERRETT. *Sugar Beet J.*, 1961, **25**, (8), 1–3.—The techniques of weed control are described.

Cytological studies of sugarcane and its relatives. XVI. Further studies of basic chromosome number of *Saccharum officinarum* L. : F_1 hybrid of Vellai and *Sclerostachya fusca A. Camus.* K. C. SHANG *et al. Bot. Bull. sin.*, 1960, **1**, 23–27; through *Plant Breeding Abs.*, 1961, **31**, 2330.—Meiotic observations are reported on the F_1 clone ($2n = 55$) of *Saccharum officinarum* "Vellai" ($2n = 80$) × *Sclerostachya fusca* ($2n = 30$) which was used for the initial back cross referred to in the previous paper in this series[1]. The modal configuration at metaphase I was $20_{II} + 15_{I}$, indicating complete autosyndesis of the 40 chromosomes derived from sugar cane. Most of the *Sclerostachya* chromosomes were noticeably larger than those of sugar cane. Some of the chromosomes from sugar cane occasionally failed to form bivalents, the maximum number of univalents being 25, together with 15_{II}, as seen in 2 out of the 100 PMC's examined. The maximum number of bivalents formed by *Sclerostachya* chromosomes was 2, in 2 PMC's. The maximum number of trivalents, presumably consisting of two sugar cane chromosomes and one from *Sclerostachya*, was 2, in 1 PMC. A single quadrivalent, attributed to association of sugar cane chromosomes, was found in 13 cells.

* * *

Anatomical peculiarities of two interesting clones of *Saccharum officinarum* L. A. S. ETHIRAJAN. *Curr. Sci.*, 1960, **29**, 396–397; through *Plant Breeding Abs.*, 1961, **31**, 2335.—Observations are reported on the anatomy of 51NG121 and 51NG131 from New Guinea, respectively characterized by short lop-sided internodes interpolated at intervals between normally developed internodes, and by oval internodes.

* * *

Stem epidermal pattern of pubescent culms in certain clones of *Saccharum officinarum* L. U. VIJAYALAKSHMI and A. S. ETHIRAJAN. *Curr. Sci.*, 1960, **29**, 400–401; through *Plant Breeding Abs.*, 1961, **31**, 2336.—The normal stem-epidermal pattern in *S. officinarum* is made of long cells in straight rows and interspersed groups of short "cork" and "silica" cells. In the clones Pelo de Moca, RG Ventre, Luhu 75, 51NG89 and NC32, long, uni-cellular and vacuolar hairs developing from the walls of the silica cells were present, in addition to the long and short cells. In the highly pubescent clones, over 60% of the silica cells were transformed into hairs and the long cells were unusually short. It is suggested that this unusual type of stem-epidermal pattern is suitable for genetical study.

[1] *I.S.J.*, 1960, **62**, 336.

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THE DETERMINATION OF SOLID IMPURITIES IN SUGAR SOLUTIONS

By PETER HIDI and GWYNNETH McINTYRE
(Research Department, The Colonial Sugar Refining Co. Ltd., Sydney, Australia.)

Introduction

THE amount of solid impurities in solutions of sugar products has a great influence on their filtering quality and an empirical relationship has already been found between these two factors[1,2]. Since this suspended matter has such a harmful effect on filtrability a more intensive study of it is necessary.

These insoluble materials differ widely chemically and include slightly soluble inorganic salts, proteins, polysaccharides, waxes and probably some other constituents. They combine to form mixed aggregates[3], and therefore their colloid properties, e.g. particle size, lyophilic nature, electrical charge, are at least as important as their chemical composition.

The most promising methods for determining the amounts of impurities are by:

(*a*) The centrifugal removal of solids and measurement of their volume described recently by ALEXANDER and DOUWES DEKKER[4].

(*b*) Centrifugal removal followed by a standardized washing procedure and then weighing of the solids.

(*c*) Measurement of the sugar content of the solution before and after the separation of the solids and calculation by difference of the amount of insolubles removed. These methods were not suitable for our detailed study of solids because of their limited accuracy and applicability.

The main disadvantage of the first method is that only low centrifugal force (a few thousand *g*) can be applied without breaking the special tubes required for the volumetric measurements. This difficulty was partly overcome by working with 50 Bx solutions. This, however, involves a further problem as some of the solids are dissolved and the method is still far from giving a quantitative removal of solids at the relatively low *g* value which the tubes will withstand.

The second method is unsuitable because the washing needed to remove the sugar from the sediment dissolves a considerable amount of the suspended matter.

The third method is suitable for such products as "C" syrup, but on samples of higher purity the very small differences in sugar content before and after solid removal greatly reduce the accuracy of the determination[5].

In the new method, sufficient centrifuging is applied to remove as much of the solid impurities as is practicable, the bulk of the clear supernatant syrup being decanted, and the sediment and remaining liquor evaporated to dryness. The dried matter is weighed and its sugar content determined polarimetrically. From this sugar content and the purity of the supernatant syrup the total content of soluble solids in the dried material is calculated and by subtracting this from the weight of dried matter the weight of sediment is obtained with an accuracy of about 2·5%.

Experimental

Solutions of liquors, syrups and sugars at 60°Bx were used. A preliminary filtration through a 150 mesh British Standard sieve removed any large particles. Centrifuging was carried out in a Spinco Model "L" ultra-centrifuge using 1½ in × 4 in Lusteroid tubes.

Duplicate samples of 100 g syrup were weighed into tubes and spun at a speed of 19,000 r.p.m. (equivalent to 52,000 *g*) for three hours. The clear supernatant solution was decanted from the sediment using a glass rod to prevent any loss of solids. The tubes containing the sediment and any remaining syrup were dried in a vacuum oven at 70°C for several hours, and the residue in the tube broken up and dried to constant weight.

The contents were transferred quantitatively to volumetric flasks and the weight calculated after weighing the dried tubes. Ammonia-ammonium chloride buffer[5] (1 or 2 drops) was added to the flasks and the solutions heated for ½ hour in a boiling water bath, cooled, and diluted to volume. The solutions were clarified with basic lead acetate, filtered with "Supercel" through Ford filter paper, and direct polarizations made.

The sugar content (by direct polarization) of the residue was calculated neglecting the effect of reducing sugars. A direct polarization and total solids determination were also made on the supernatant syrup. Then $W_1 = W - \frac{WTA}{100B}$ where W_1 is the weight of solid impurities, W is the weight of dry residue, T is the percent total solids in the centrifuged syrup, and A and B are the sugar contents of the dry residue and the centrifuged syrup respectively. Because the ratio of reducing sugars to sucrose was the same in both the residue and the centrifuged syrup the effect of reducing sugars can be disregarded.

[1] NICHOLSON *et al.*: *I.S.J.*, 1961, **63**, 173–176, 201–204.
[2] DAVIS: *I.S.J.*, 1959, **61**, 300–302, 331–333.
[3] BENNETT: *J. Colloid Sci.*, 1957, **12**, 434–451;
[4] *S. African Sugar J.*, 1959, **43**, 607–613; *I.S.J.*, 1960, **62**, 24.
[5] SCHWARZENBACH: "Complexometric Titrations." (Methuen, London.) 1957. p. 59.

If the test sample has a high purity and only moderate accuracy is required $\frac{T}{B}$ may be replaced by $\frac{100}{\%\ \text{purity}}$ of the original sample (usually known from routine analysis). This substitution neglects the effect of the solid impurities on the total solids content and does not compensate for the reducing sugar error in the sugar content of the residue.

Discussion

The accuracy of this method depends mainly on the completeness of the centrifugal sedimentation. High speed and long spinning time are necessary to settle nearly all the impurities and were selected to give a separation of solids such that a 50% increase in either centrifugal force or time did not increase measured solids by 6%. As these results were being used in conjunction with a study of filtration the standard time and speed were checked by showing that the filtrability of the supernatant syrups did not further increase with either greater centrifugal force or longer spinning time.

Figures 1 and 2 show the effect of centrifugal force and centrifuging time on the solid impurities removed from a B" syrup and a "C" sugar at 60°Bx. The broken curve in Fig. 2 shows the results from the same "B" syrup at 50°Bx.

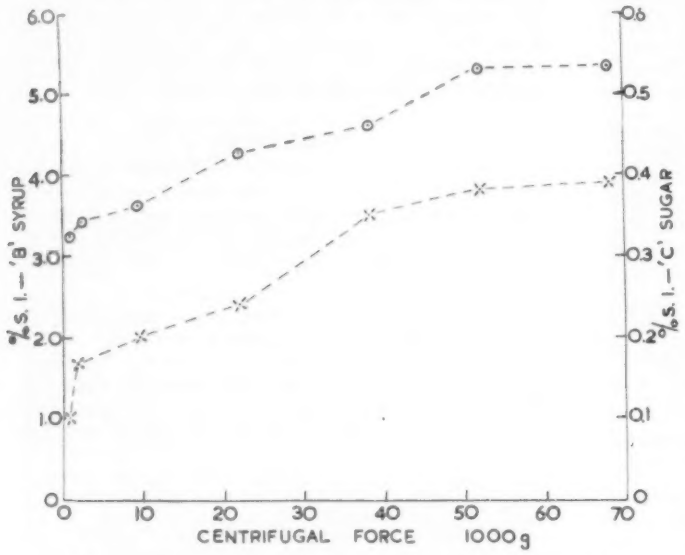


Fig. 1. The effect of centrifugal force on the removal of solid impurities.
⊙ No. 1 B Syrup. × No. 1 C Sugar.

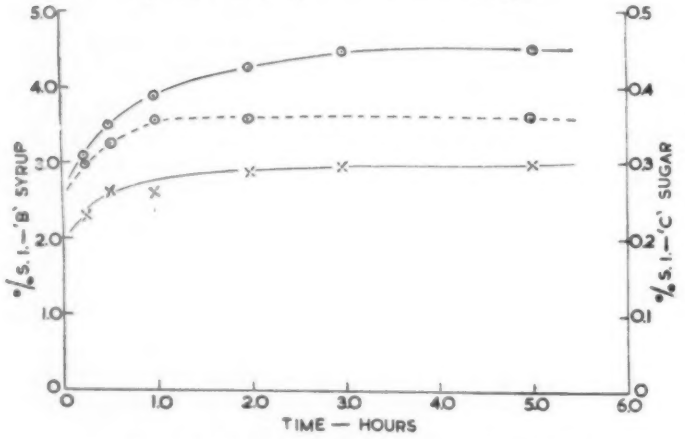


Fig. 2. The effect of centrifuging time on the removal of solid impurities.
⊙ No. 2 B Syrup. × No. 2 C Sugar.
——— 60°Bx solution. - - - - - 50°Bx solution.

The Brix of the samples is important in standardizing the centrifugal procedure. With increase in dilution the necessary spinning time decreases not only because of the viscosity decrease in the syrup but probably because dilution considerably affects the density difference between the syrup and the suspended particles. On the other hand, dilution dissolves a significant quantity of the solids and therefore can introduce a systematic error as is shown in Fig. 3. Standardization at a dilution of 60°Bx was a compromise being near the concentration used in the factory and yet lowering the density sufficiently to allow a reasonable time of centrifugation.

All centrifuging was carried out at room temperature as there were no facilities for work at elevated temperatures. It is thought that centrifuging at 60°–80°C would reduce the spinning time to a fraction of the present three hours.

The reproducibility of replicates showed that the probable error of one single determination is ± 1·8%. The accuracy of the method was tested by adding known weights of finely powered barium

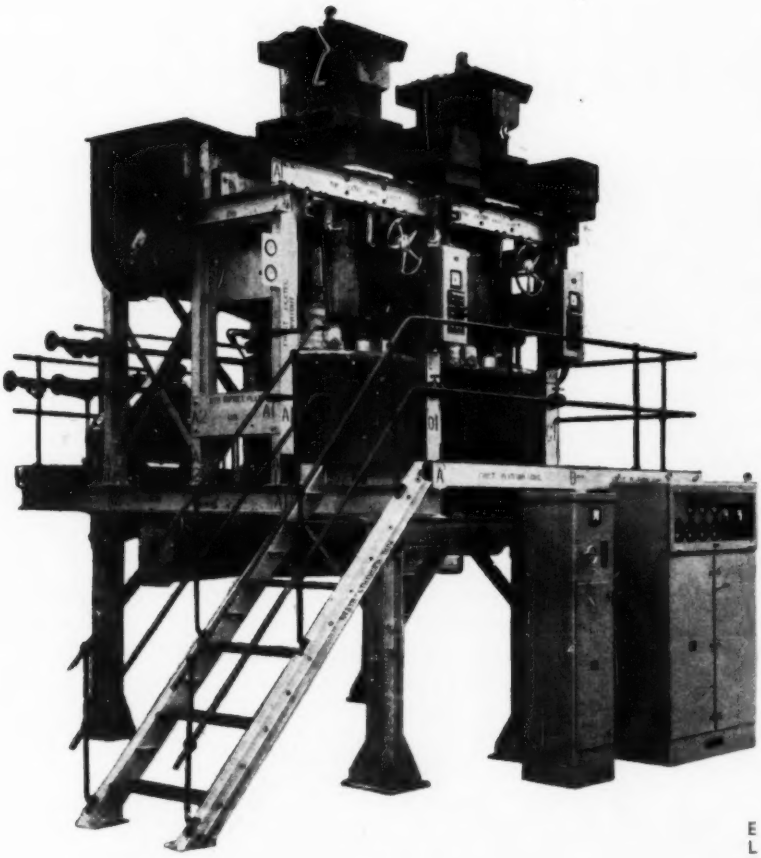
Table 1

Recovery of $BaSO_4$ from sugar solutions

$BaSO_4$ *added* % *on sugar*	$BaSO_4$ *recovered* % *on sugar*	% *difference*
0·150	0·148	— 1·3
	0·153	+ 2·0
0·250	0·259	+ 3·6
	0·245	— 2·0
0·500	0·511	+ 2·2
	0·507	+ 1·4
	0·503	+ 0·6
	0·501	+ 0·2
	0·492*	— 1·6
	0·504*	+ 0·8
0·800	0·795	— 0·6
	0·817	+ 2·1

* 10% reducing sugar added.

FROM PC&W



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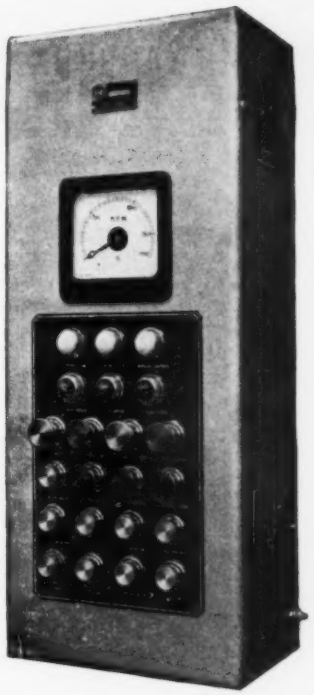

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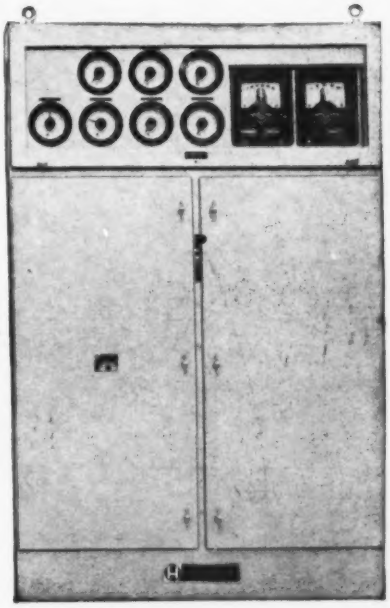

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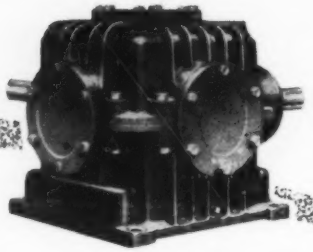

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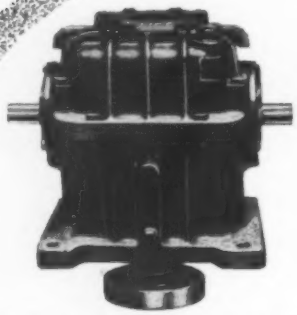

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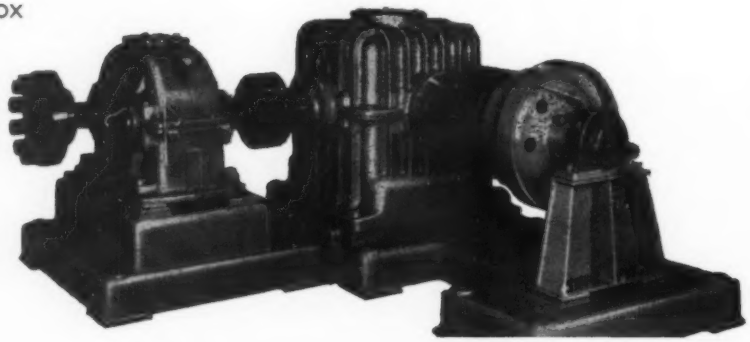

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sulphate to 60°Bx pure sugar solutions and determining the solid impurities (Table I). The standard deviation of the % differences is 1·7.

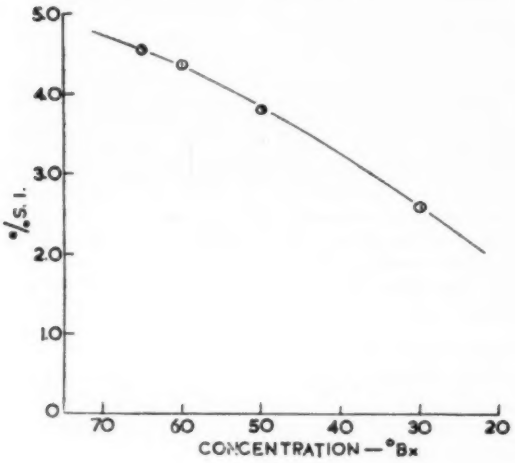

Fig. 3. The effect of dilution on the amount of solid impurities removed from No. 2 B syrup.

Application of the Method

Table 2 shows the solid impurity content of several intermediate mill sugar products expressed as a percentage of the soluble solid content (by refractometer) of the original sample. The table illustrates the large variations in the same grade of intermediate product.

Table 2

Solid impurity content of various sugar products

Product	*No.*	*Solid Impurities % on soluble solids*
Raw Sugar	1	0·107
	2	0·134
	3	0·190
"C" Sugar	1	0·38
	2	0·30
	3	0·46
Liquor	1	0·37
	2	0·64
	3	1·07
"A" Syrup	1	0·43
	2	1·22
	3	1·79
"B" Syrup	1	5·3
	2	4·5
	3	7·4
Molasses	1	3·8
	2	7·5
	3	8·2

The formation of insoluble solids can be traced throughout the raw sugar manufacturing process by determining insoluble solids in appropriate products, e.g. from the solid impurity content of a clarified juice (0·24%) and the liquor boiled from it (0·35%) the solid impurities formed were calculated (0·11%). This result was checked by centrifuging another sample of the clarified juice before boiling the liquor; the solid impurity content of the resulting liquor was 0·13%.

Solid impurity measurements were applied to test the effect of lime saccharate addition to syrups. In most cases the solid impurity content increased at higher pH but some syrups behaved in the opposite way, underlining the chemical differences in the insoluble solids of various products (Table 3A).

Table 3A

Effect of lime saccharate addition on the solid impurity content of sugar solutions

	Solid impurity % on Soluble solids	
Product	*Natural pH*	*pH 9*
"A" Sugar	0·135	0·150
"C" Sugar	0·30	0·31
"B" Syrup	4·5	4·1

Solid impurity determinations were used to study the solubility of the solids on dilution. It was found that dilution with filtered pure syrup always results in a considerable decrease in solid impurities by solution (Table 3B). This effect is not shown if the dilution is followed by a pH adjustment to 8·7–9·0. This is probably due to the Ca^{++} and OH^{-} ions tending to depress the solubility of the slightly soluble inorganic salts. In these results the solid impurity percent is calculated on the soluble solid content of the original product (i.e. % solid impurity of the diluted sample multiplied by the dilution).

Table 3B

Effect of dilution and lime saccharate addition on the solid impurity content of sugar solutions

Product	*Dilution with pure syrup*	*Solid impurity % on original product* *Natural pH*	*pH 9*
"C" Sugar	—	0·46	0·45
	3·33 times	0·40	0·50
	4·27 ,,	0·35	0·42
	6·00 ,,	0·32	0·46
Liquor	—	0·64	0·67
	4·00 ,,	0·47	0·65

Summary

A simple method has been developed to measure the solid impurity content of different sugar products. The method consists of centrifugally separating the solid impurities from a 60°Bx solution, followed by drying and weighing and correcting the weight by subtracting the weight of syrup held in the sediment. The method is accurate and has the advantage that the slightly soluble fraction of the impurities is not dissolved by washing or excessive dilution. Examples of the application of the method in the cane sugar industry are given.

Acknowledgments

The work described in this paper was carried out in the Research Department of The Colonial Sugar Refining Co. Ltd., Sydney. The authors wish to thank the Management of the Company for permission to publish this paper and Mr. R. I. Nicholson for helpful discussion.

DETERMINATION OF THE SACHS-LE DOCTE VOLUME OF SUGAR BEET GROWN IN ISRAEL

By G. ZIMMERMANN (Div. of Food and Biotechnology, Technion Israel Institute of Technology, Haifa) and E. ROSEN (Israel Sugar Beet Research Council, Affula).

Introduction

THE highest possible degree of accuracy in de-determining the sucrose content of the beets is required in order to establish price rates in the beet sugar industry, and calculate the sugar balance in the production process. This is especially the case where the growing of sugar beet and its industrial utilization are fields of new enterprise and where unfavourable climatic conditions entail sugar losses in various forms. Of the two alternative methods of sucrose determination (Pellet's flask method and Sachs-Le Docte's pipette method) the latter was adopted by the local sugar industry with a view to obviating the complicated and time-consuming preliminary determination of the volume of the marc and the lead precipitate error involved in the Pellet method. The Sachs-Le Docte procedure, however, entails preliminary determination of the average juice volume.

The juice volumes corresponding to the International normal weight of 26 g of brei are reported in the relevant literature as ranging from 20·7 ml[1] to 23·0 ml[2]. Thus, if a solution containing a normal weight of brei per 200 ml is used for polarimetry, the Sachs-Le Docte (S.L.D.) volume varies between 179·3 and 177·0 ml.

The objects of the experiments reported in the present paper were (a) determination of the juice volume of different sugar beet samples with the aid of the d'Orazi method[3] as applied by PARKER[4], with a view to obtaining a statistically significant estimate of the average S.L.D. volume to be used for sugar beet grown in Israel; (b) critical examination of the method in question compared with the Krocher-Daeschner-Bauer procedure[5].

Material and Methods

During the 1959 and 1960 campaigns (each lasting from early May to the second half of July) a total of 230 random samples were analysed. The samples were prepared with the aid of a "Kleinwanzleben" beet saw and treated according to the accepted methods in the laboratories of the Israel Sugar Works, Affula.

The d'Orazi-Parker Method

This method is based on the assumption that all sugar is present in the liquid phase of the brei; hence 23 ml of press juice should contain the same quantity of sucrose as a brei of normal weight, provided the conventional S.L.D. volume is 177 ml in both cases.

Press juice was obtained on a Carver laboratory press at an average working pressure of 70 kg/sq.cm. For defecation, 177 ml of 5° Brix basic lead acetate solution (B.L.A.) were added to 23 ml press juice. For the cold digestion a normal weight with 177 ml of the same B.L.A. solution was macerated in a hermetically closed "Osterizer" for 2 minutes at 10,000 r.p.m. The conditions of filtration and further treatment were identical for the press and brei juices. Polarization was determined on the Schmidt & Haensch saccharimeter by averaging the values of 5 consecutive readings. For calculation of the corrected S.L.D. volumes, the formula developed by PARKER was used, viz.:—

$$\text{S.L.D.}_{corr.} = 200 - \frac{20{\cdot}36P_1}{P_2 - 0{\cdot}115P_1}$$

where P_1 = polarization of a normal weight of Brei after cold digestion with 177 ml B.L.A. and P_2 = polarization of 23 ml press juice after pre-treatment as mentioned above.

The formula is based on the relationship: $S = \frac{(177 + V)\,P_1}{200} = \frac{V\,P_2}{23}$ where S = sucrose content of the Brei in % weight and V = Juice volume of a normal weight of Brei = 200 — S.L.D.$_{corr.}$.

The Krocher-Daeschner-Bauer Method

With this method, the use of press juice is obviated. The brei juice is prepared as above. For defecation 177 ml 5° Brix B.L.A. solution are taken as above and the polarization (P_1) determined. In a parallel experiment, a normal weight of brei is defecated using the same quantity of B.L.A. solution containing in this case 10% pure sucrose; afterwards polarization (P_3) is determined. Correction is obtained by means of polarization (P_4) of 177 ml B.L.A. solution containing 10% sucrose, with water added to give a volume of 200 ml. Calculation of the corrected S.L.D. volume is based on the following formula:

$$\text{S.L.D.}_{corr.} = 377 - 200.\frac{P_4}{P_3 - P_1}$$

Johnson Method[6] for production of Brei juice

200 g brei are macerated with 200 ml distilled water in an "Osterizer" at 80°C for 4 minutes. The brei juice is separated from the pulp by straining through filter cloth and quickly cooled to room temperature before the necessary determinations are carried out.

All the following data are average values of duplicated determinations.

[1] HUNGERFORD AND KOONTZ: *Proc. 8th Meeting Amer. Sugar Beet Tech.*, 1954, 303.
[2] SACHS and LE DOCTE: cit. in: BROWNE & ZERBAN: "Physical and Chemical Methods of Sugar Analysis" (Wiley, New York) 1948, p. 366.
[3] *Ind. Sacc. Ital.*, 1952, **45**, 82.
[4] *I.S.J.*, 1958, **60**, 197.
[5] MACLAY *et al.*: *Proc. 8th Meeting Amer. Soc. Sugar Beet Tech.*, 1954, 298.
[6] *Proc. 5th Meeting Amer. Soc. Sugar Beet Tech.*, 1954, 272.

Results and Discussion

Determination of the corrected S.L.D. volumes according to D'Orazi-Parker

Table 1 summarises the results obtained in the course of two years of experiments and their statistical analysis[7]. The table shows a statistically significant difference, for each of the two years of experiment, between the conventional and the corrected S.L.D. volumes. The differences between the corrected S.L.D. volumes calculated in both years of experiment are also statistically significant.

Table 1.—Corrected S.L.D. volumes for Israel grown beet

Year of experiment	*1959*	*1960*
Number of beet samples	118	112
Average corrected S.L.D. volume (ml)	177·71	178·18
Standard deviation of corrected S.L.D. volume (ml)	0·092	0·086
Statistical range (P:0·01 of corrected S.L.D. volume) (ml)	177·47–177·95	177·95–178·41
Average sugar concentration in the beets, according to		
conventional S.L.D. volume (%)	16·27	17·42
corrected S.L.D. volume (%)	16·21	17·32

On the basis of these results, it can be concluded that beets with a relatively high average sugar content and relatively low apparent purity have a juice volume lower than conveniently accepted. Hence a higher S.L.D. volume should be used for their preparation in the laboratory. This evidence is consistent with the findings of Bachler[8] for beets grown in California.

Comparison of purities of press and brei juices

The validity of the conclusion is based on the assumption that the press juice and brei juice after disintegration are of identical composition[9, 10]. In order to verify this assumption, diluted brei juices were prepared according to the Johnson method (loc. cit.). In both, the Brix was determined by refractometer and, after dry defecation, the juice was polarized and the purity calculated. Were the compositions of both juices identical, the ratio of the purities would not significantly differ from the theoretical value of 1·00. Results of the comparison and their statistical analysis are given in Table 2.

Table 2.—Difference in purities* between press and Brei juices.

Number of samples	46
Average purity of the press juice (Q_1)	83·7
Average purity of the brei juice (Q_2)	79·2
Ratio Q_1/Q_2	1·0547
Standard deviation of ratio	0·004
t for the difference between the determined ratio and the theoretical value of 1·00	13·7
t for statistical significance (P:0·01)	2·7

* Since the samples for this experiment were taken at the end of the campaign, the purities are relatively low.

Comparison of the two *t*-values shows that the average purities of the press and brei juices differ to a highly significant extent. For beets of higher purity, this difference may prove smaller, but this would not change the fact that a method based on press juice has only limited informative value.

Influence of pressure on the value of the corrected S.L.D. volume

In a further experiment, the influence of pressure on the corrected S.L.D. volume, determined according to d'Orazi-Parker, was studied. The brei juice was produced by cold digestion. The press juice had been gathered from two pressure steps and treated separately. Table 3 summarises the results.

Table 3.—Influence of pressure on the value of the corrected S.L.D. volume.

Number of Samples	*pressure (kg/sq.cm.)*	*Corrected S.L.D. volume*
10	up to 55	177·97
10	56 – 145	178·30

In view of the small number of samples and of the high variable sugar contents (13·10–21·37%) no statistical analysis of the experimental results was attempted. However, in agreement with the summary of Hirschmüller and Hörnung[11], it can be assumed that the composition of the press juice varies with pressure. These differences in composition influence the calculated S.L.D. volume.

Examination of the Krocher-Daeschner-Bauer Method

In this method, the change in polarization of a B.L.A. solution containing 10% sucrose by a normal weight of brei with more or less than 23 ml juice is used as a measure for the correction of the S.L.D. volume.

Since the extraction of sugar from brei is also a function of the concentration of the defecation solution, B.L.A. solutions containing 5% and 10% sucrose were compared in order to evaluate the method. Table 4 summarizes the corrected S.L.D. volumes determined with different sucrose concentrations. The difference between the corrected S.L.D. volumes due to different concentrations in the B.L.A. defecation solutions is significant.

Table 4.—Influence of the sucrose concentration in the B.L.A. solution on the corrected S.L.D. volume

Number of samples	16
Average corrected S.L.D. volume using B.L.A. solution with	
10% sucrose (ml)	177·01
5% sucrose (ml)	178·47
Average difference between the S.L.D. volumes (ml)	1·46
Standard deviation of the difference	0·611
t for difference	2·39
t for statistical significance (P:0·05)	2·04

Conclusions

Both the D'Orazi-Parker and Krocher-Daeschner-Bauer methods were found unsuitable for determination of the actual S.L.D. volume. The disadvantage of the first method lies in the different composition of the brei and press juices, and that of the latter in

[7] Snedecor: "Statistical Methods" (The Iowa State College Press, Ames.) 1946.
[8] *Facts about Sugar*, 1937, **32**, 327.
[9] Genotelle: *Sucr. Franç.*, 1949, **90**, 20.
[10] Carolan: *I.S.J.*, 1951, **53**, 158.
[11] *Zeitsch. Zuckerind.*, 1959, **9**, 389.

the influence of the concentration of the sucrose in the defecation solution. Therefore, both methods yield only approximate values for the corrected S.L.D. volume.

Determination of the actual S.L.D. volume corresponding to the average actual conditions in the sugar factory, seems to be feasible in pilot plant experiments only. Such a plant, to be erected here according to the suggestions of MORGAN *et al.*[12] and ASSELBERG *et al.*[13] will, in future, also serve the purpose of determining the actual S.L.D. volume.

ACKNOWLEDGMENT

The authors should like to express their gratitude to the Israel Sugar Beet Research Council for financing the project. They are also indebted to the Israel Sugar Works, Affula, for placing the necessary laboratory facilities at the disposal of the working group.

ADSORPTION BY BONE CHAR USING A CONTINUOUS ADSORPTION PROCESS (CAP)

By WILLARD MARCY, Ph.D.

Division Head, Process Development, Research and Development Division, The American Sugar Refining Company

Paper presented at the Twentieth Annual Meeting, Sugar Industry Technicians Inc., 1961.

PART I

INTRODUCTION

IN the nineteenth century sugar refiners were at the frontier of scientific and engineering knowledge. Multiple-effect evaporation, centrifugation and pressure filtration were major contributions. The first large scale use of a combined adsorbent and ion exchange material was the treatment of sugar liquors by bone char. Semi-continuous processing was first used in the sugar industry.

Many of the present-day refineries were built during this period or shortly thereafter. These refineries were built to last and did. However, the equipment and processes originally installed in many of these plants are now obsolete and must be modernized. Extremely competitive conditions and high wage costs are forcing refiners to-day to look for processes and equipment which will fill the twin requirements of minimum capital investment and low operating cost.

With five refineries varying in age from about 35 to 100 years, The American Sugar Refining Company was faced some five years ago with the necessity of rebuilding or modernizing on a major scale. The char house was obviously a part of a cane sugar refinery especially ripe for the application of modern chemical engineering techniques, including automation. With the encouragement of management, the Research & Development Division of the Company embarked on a major programme to design as modern a char house as possible.

The major objectives were to attain: (1) minimum capital investment: (2) minimum operating and maintenance cost; (3) continuous operation; (4) improved quality of product; (5) a highly versatile process; (6) minimum use of adsorbent; and (7) minimum production of sweetwater.

With these objectives in mind, initial experiments were begun in 1957 to discover whether a continuous, counter-current liquid-solid contacting system could be used in cane sugar refining. The first exploratory decolorizing experiments were done using a 6-inch diameter column.

As these experiments were successful, a pilot plant was designed to include de-sugaring, de-ashing, and adsorbent reactivation equipment as well as decolorizing columns. The capacity of this miniature "char house" was about 600 gallons of sugar liquor per hour. The decolorizing column was 4 feet in diameter with a 27 foot bed depth.

After about 18 months of operation, enough data had been obtained to enable the design of a full-scale commercial unit. During this period it was obvious that the entire system was not only technically feasible, but also had important economic advantages. It was, therefore, only natural that the first commercial cane sugar installation was designed for integration into the Bunker Hill (Boston) Refinery plans, which were then on the drawing boards.

U.S. Patent coverage was applied for and one patent has been recently granted[14]. The system was named the Continuous Adsorption Process (CAP). Patent applications have also been filed in foreign countries.

[12] *J. Amer. Soc. Sugar Beet Tech.*, 1959, **10**, 563.
[13] *Zucker*, 1960, **13**, 574.
[14] U.S. Patent 2,954,305; *I.S.J.*, 1961, **63**, 28.

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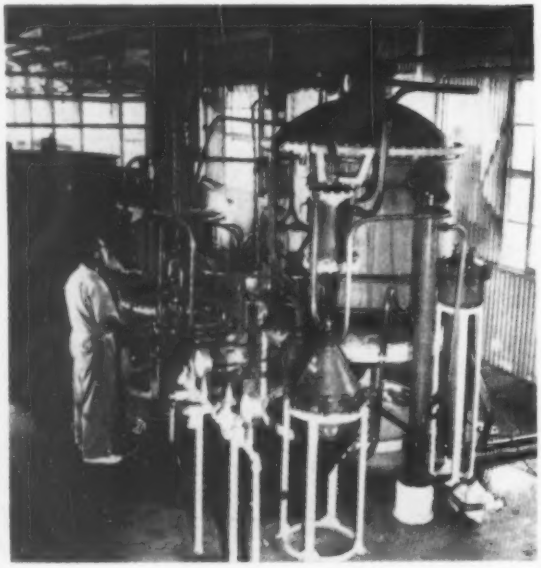

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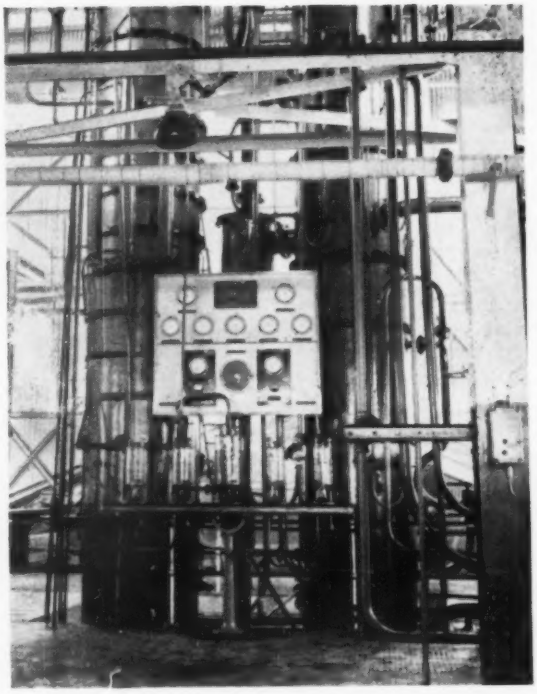

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General Description of the CAP System

A line diagram of the process is shown in Fig. 1. The main melt stream is de-aerated just after conventional mechanical filtration. The de-aerator serves the dual purpose of adjusting both the density and temperature to any desired values suitable for processing in the CAP. The liquor is then fed to the bottom of a decolorizing column. Decolorized and de-ashed product liquor is obtained from the top of this column. Dry reactivated adsorbent is fed to the top of the decolorizing column and emerges from the bottom, slurried with liquor. This slurry is first partially deliquored, and then the remaining sugar is removed in a de-sugaring column by counter-current action of water. Adsorbed ash is removed subsequently in a de-ashing column, also by a counter-current water wash. The adsorbent is discharged from the de-ashing column in a water slurry. Excess water is removed, and the wet adsorbent is then dried and reactivated in a multiple-hearth kiln. The reactivated adsorbent is cooled, screened and returned to the decolorizing column.

Decolorizing Column

The decolorizing columns at Bunker Hill are 12 ft in diameter and have 40-ft beds of bone char adsorbent.

Unlike conventional stationary-bed char cistern operation, both the adsorbent and the sugar liquor move. The sugar liquor moves upward at a uniform rate, while the adsorbent moves downward, also at a uniform rate, but much slower relative to the liquor.

In order to utilize the adsorptive capacity of the adsorbent to the fullest extent, the particles of adsorbent are separated very slightly, one from another, thus allowing all adsorbent surfaces to be in intimate contact with the sugar liquor at all times. This condition of adsorbent bed is easily obtained by proper adjustment of liquor flow rate and viscosity. When in this desirable state the adsorbent bed is "expanded". This state can be visualized as being part way between the packed bed of a conventional char cistern and a fluidized bed used in many oil refinery catalytic processes. In sugar liquor decolorization, neither the packed bed, nor the fluidized bed gives the most efficient decolorization. Only the expanded bed will result in maximum colour removal.

The expanded bed serves another purpose as it prevents any channelling or bypassing of liquor by providing a great number of tiny channels, all allowing about the same ease of passage of the liquor over the entire bed cross-sectional area and for the total height of the bed.

The true continuous counter-current nature of the operation also contributes to the success of CAP on sugar liquor. In this system the adsorbent with the highest adsorptive capacity automatically contacts the liquor with the lowest level of impurities at the top and the partially exhausted adsorbent contacts the liquor with the highest level of impurities at the bottom, thus taking advantage of favourable diffusion and adsorption equilibria. This ideal contacting situation can be only very roughly approximated in a conventional char cistern, and then only through a complicated physical manipulation by blending of liquors.

The expanded bed plus the true counter-current liquor-adsorbent contacting operation result in a low-colour product liquor of uniform quality. No liquor blending is required, and thus no liquor gallery is needed. Furthermore, the colour of the product liquor can be adjusted at will by simply adjusting the feed rate of the adsorbent relative to that of the liquor.

To ensure maximum utilization of the adsorbent bed over its entire cross-sectional area, the feed liquor is introduced through a carefully designed system of evenly spaced

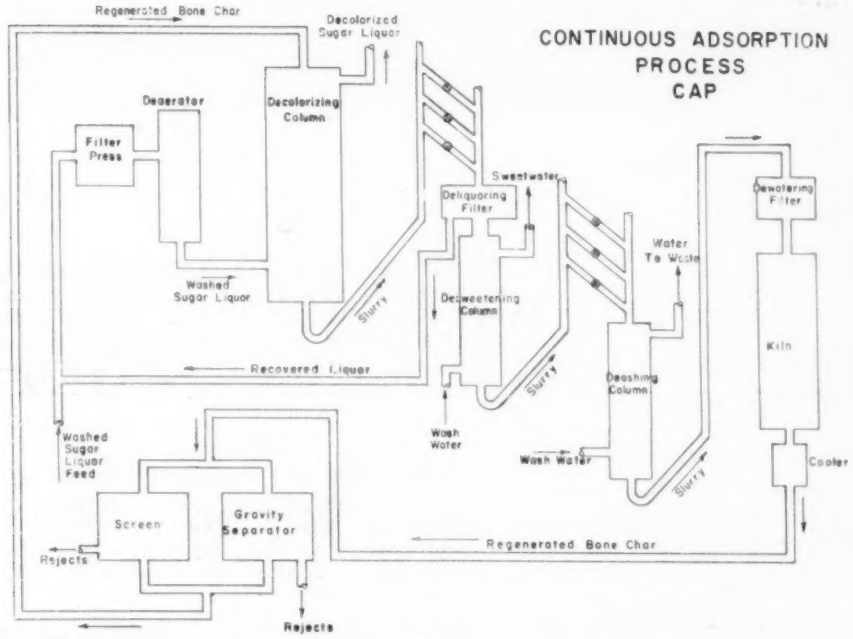


Fig. 1

sparger feeder pipes conducted to a common manifold (Fig. 2). The space between these pipes allows downward movement of the bone char bed. Facing downward on each branch pipe is a row of evenly spaced orifices which admit liquor at low pressure. About 85% of this liquor flows upward through the bone char bed. The other 15% flows downward with the bone char.

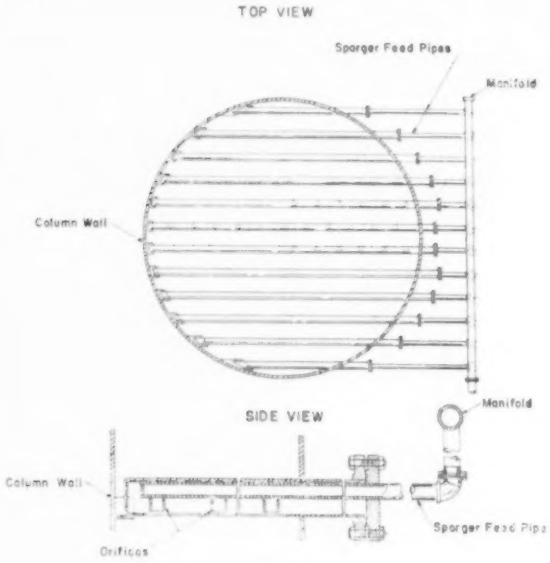


Fig. 2

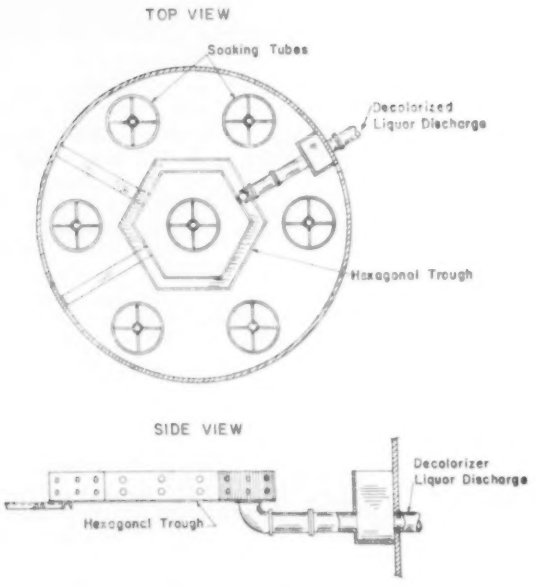


Fig. 3

The upward flowing liquor is decolorized and is drawn off the top of the column by a hexagonal trough (Fig. 3) so designed as to remove approximately an equal quantity of liquor per unit area of column thus contributing to the avoidance of channelling.

Regenerated bone char is fed to the top of the column through a pipe which has a series of slots at its lower end. A sliding sleeve provides a gate for these slots (Fig. 4). The gate is raised or lowered to control the amount of char which flows into the feed chamber and down the supply lines to the soaking tubes. The soaking tubes extend down into the decolorized sugar liquor so that the dry char will be freed of air and wet with liquor before falling on the char bed. The tubes are spaced in such a manner as to provide equal char feed per unit area of column.

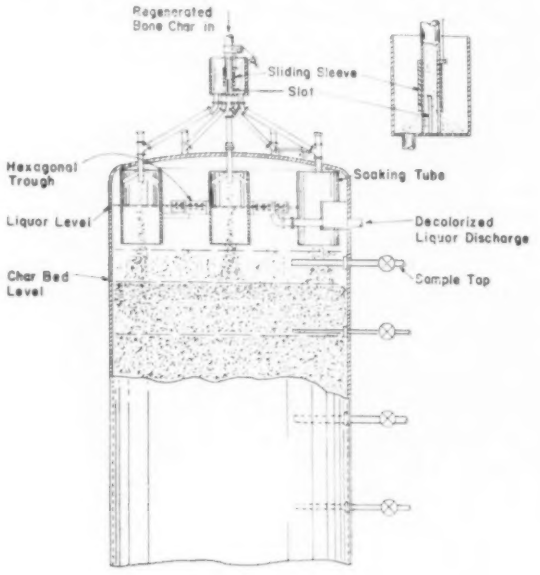


Fig. 4

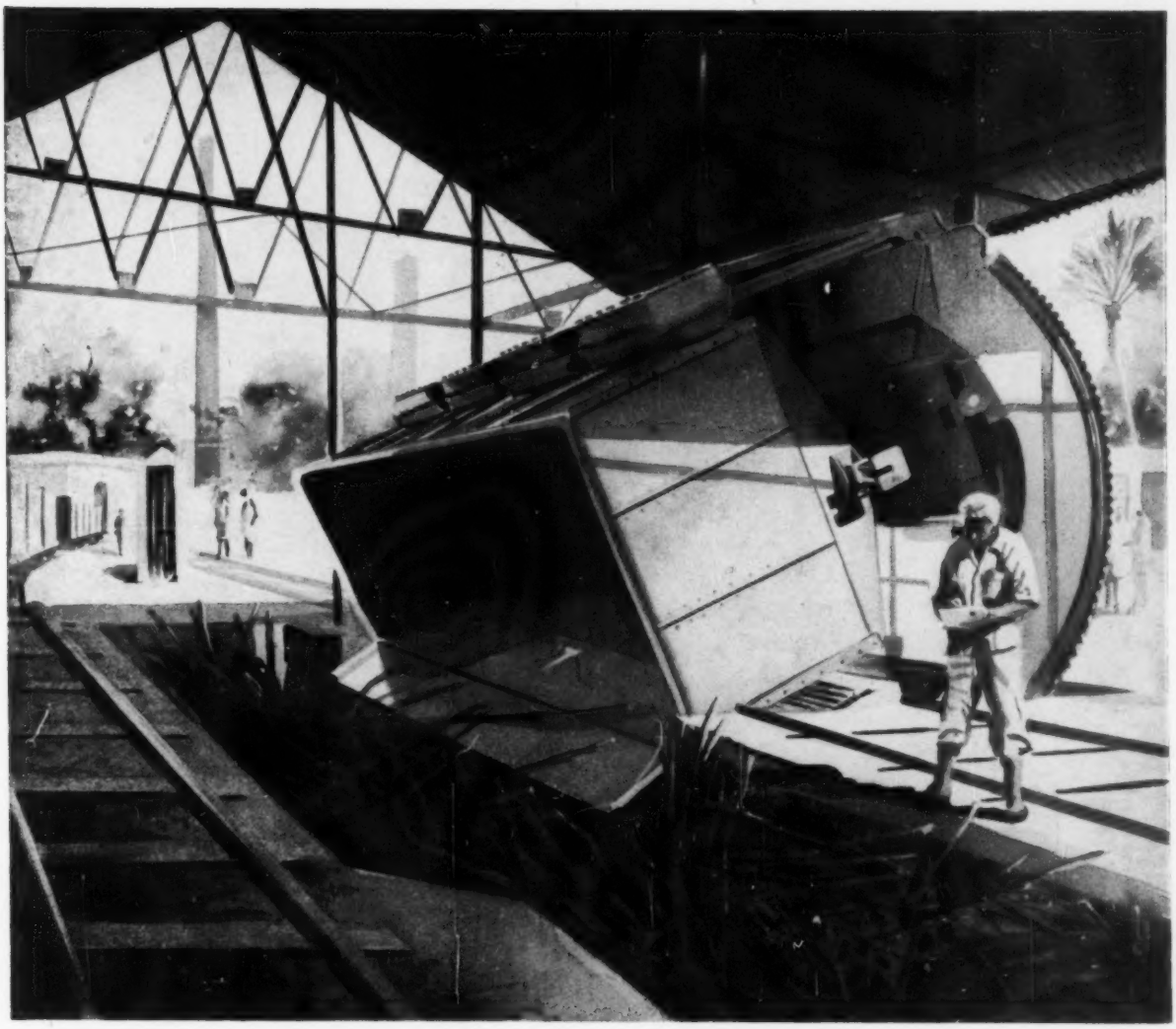
The velocity of liquor flow up the bed is generally expressed in feet per hour assuming an empty column. This is called superficial velocity. Table I shows approximate values for optimum superficial velocities at feed liquor densities of 60, 63 and 65°Brix and feed liquor temperatures of 160, 170 and 180°F.

Table I

Optimum Superficial Velocities in CAP System

°Brix	*At* 160°F *ft/hr*	*At* 170°F *ft/hr*	*At* 180°F *ft/hr*
60	7	8·5	10
63	5	6	7
65	4	5	6

The amount of bone char used depends on the colour of the sugar liquor fed and the degree of



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decolorization desired. The volume of liquor going up the column divided by the volume of char going down the column is called the liquor to char volume ratio. This may be varied at will.

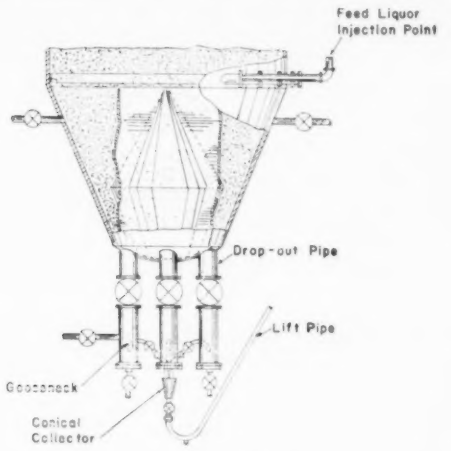

Fig. 5

Spent bone char is discharged continuously from the bottom of the column in the form of a slurry with the down-flowing 15% of the sugar liquor feed. Below the feed liquor injection point, the column shape is conical and the bottom is rounded (Fig. 5). An inverted cone with apex at the column centre directs the slurry flow equally per unit area into four compartments. At the bottom of each compartment is a drop-out pipe which extends downward below the bottom of the column. From the drop-out pipe a gooseneck conducts the char slurry into a conical collector. The hydraulic head in the column forces the slurry through the conical collector and up the lift pipe to a series of cross-over pipes at different heights below the liquor level in the column. By selecting one or another of these crossover pipes the operator can control the discharge height and, therefore, the flow rate of the slurry. This, in turn, controls the bone char bed depth.

(*To be continued*)

SUGAR CANE MECHANIZATION SEMINAR

DURING the week commencing the 22nd October 70 delegates from 14 foreign countries were participating in the First International Sugar Cane Mechanization Seminar in Jeanerette, Louisiana, sponsored by J. & L. Engineering Company Inc., of Jeanerette.

Countries represented at the seminar include Argentina, Mexico, Venezuela, Puerto Rico, Guatemala, Jamaica, the United Kingdom, Colombia, Philippine Islands, Peru, United States, British Guiana, Costa Rica and Nicaragua. The bi-lingual conference will be held semi-annually, according to LAWRENCE LAMPO, Jr., seminar director. The new technical school emphasized the American method of mechanized agriculture and also included other phases of the Louisiana growing and processing technique from the preparation of the land to the final milling of the cane.

During the week that the international visitors spent in the South Louisiana sugar belt they journeyed to cane fields in Iberia and St. Mary Parishes for an on-the-ground survey of the mechanical cutting of sugar cane, mechanical loading in tractor-driven carts and transport to the factory. They studied self-propelled and tractor-attached harvesters, observed cane loaders in action and watched area sugar mills perform procedures as varying from the operation of a mill yard to the sampling and washing of cane.

American sugar cane experts from the U.S. Department of Agriculture, the Louisiana State University College of Agriculture, and the American Sugar Cane League participated in special dinner-meetings devoted to the business of mechanical cutting, loading and transporting of sugar cane in the most economical, efficient manner known in the industry. During a one-day stop at the U.S. Department of Agriculture Field Station in Houma the 70 international visitors were provided with information on cane varieties, cover crops, control of sugar cane diseases and viewed an experimental USDA harvester.

Operational cost factors of farms, plantations and factories were presented for group study and discussion, as well as model maintenance facilities at various locations. The delegates saw model field layouts where demonstrations were conducted on test plots with the necessary equipment to form and cultivate land in preparation for mechanical machinery. Films of Louisiana and Florida operations were shown and general group discussions held.

Following a review of the weeks' work the delegates to the first international seminar were presented with certificates of completion by J. M. PUGH, president, J. & L. Engineering Company, Inc. of Jeanerette, sponsors of the agricultural consultation service school. While the main order of business will be sugar cane mechanization the delegates were also treated to some of the world-famous South Louisiana hospitality. A major social function was the civic reception held in New Iberia, home of the Louisiana Sugar Cane Festival.

LAMPO and R. J. BANTA, a Louisiana agricultural specialist, presented the English phase of the programme. Dr. A. L. FORS, an agricultural consultant with widespread experience abroad, was in charge of the Spanish phase of the programme.

Influence of preparation and mill feeding on juice extraction. J. D. PERRY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 85–87.—The performance of the 84-in No. 1 mill at Proserpine was improved by shortening the main cane carrier by half and installing a 6-ft Searby shredder, after the two sets of knives, below ground level. The carrier, elevator installation, knives and shredder are automatically controlled through the killer plate of the crusher feed chute. This chute was lengthened from 5 to 12 ft and its slope altered from 45° to 60°. In 1959, although the crushing rate was increased from 137 to 142 t.c.h., average extraction at the No. 1 mill rose from 73 to 75%, while the turbine speed was reduced to 3700 from 4900 r.p.m. and the mill settings were reduced. The increased efficiency is attributed to better feeding and to improved maceration. In 1960, after further modifications to mills 2, 3 and 4, the average crushing rate was increased to 151·3 t.c.h. while the average No. 1 mill pol extraction attained was 76·1% and overall extraction 95·3%. Final bagasse moisture was 43·4%. It is considered that the overall extraction figure could be considerably improved if No. 2 mill, with which difficulties in feeding were experienced, operated normally.

* * *

Recent milling train improvements at Mossman. W. J. HARPER. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 89–91.—By installing the feed chute of No. 1 mill 6 inches further back on the feed roll, the maximum capacity of the 4-mill tandem was increased from 80 to 100 t.c.h. The performance of the small No. 2 and 3 mills (33 × 72 in) was improved by replacing their pushers with Donnelly feed chutes. These and operation with dirty top rolls helped to reduce the bagasse moisture content. No. 1 mill efficiency was raised by installing a short cane carrier with two sets of knives and a Searby shredder slighly below ground level. An 18-ft feed chute was installed and the horizontal pusher retained. (Without the pusher the crushing rate dropped by 2 t.c.h.) Uniform feeding was ensured by installing a feed roller about 4½ feet above the mill mouth and projecting about 2 in into the chute. As a result, the crushing rate was increased and extraction increased from 66·2% in 1958 to 74·5% in 1960. Slight modifications to the Donnelly chutes are described.

* * *

Real fuel economy in the cane sugar factory. G. H. JENKINS. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 93–101.—An estimate is made of the fuel saving possible with a steam cycle designed for maximum fuel economy with the aim of reducing bagasse consumption and so allowing maximum possible surplus for paper and pulp production. Starting from the steam balances given for normal steam cycles[1], modified procedures are suggested and calculations show that with 14·5% fibre in cane, 40% of the total bagasse could be saved without curtailment of maceration or other alterations to the processes which would have an adverse effect on sugar recovery.

* * *

Extrusion in bagasse compression tests. J. E. HOLT. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 103–107.—In a series of compression tests carried out in an investigation of bagasse extrusion through the mill opening, the prepared cane samples were compressed between two grooved platens in a rectangular box 9 in wide and 4 in long, i.e. the length of the effective pressure arc[2]. The platen width and grooving were the same as those of the Queensland University experimental mill. After a small amount of juice was extracted, the end plates were removed and the block of bagasse remaining further compressed. A movement of the bagasse from the ends of the box resulted in a ratio of bagasse volume: volume between platens exhibiting the same trends with compression ratio and cane preparation as the reabsorption factor. A graph is presented of the so-called "expansion factor" (inter-platen volume plus half the excess bagasse volume:inter-platen volume) *vs.* compression ratio. Despite the fact that the results obtained by extrusion are identical with those given by mill reabsorption, there is no positive proof that reabsorption is an extrusion process, although the evidence is strongly supported.

* * *

Milling studies—the effects of fibre in cane and roll diameter. C. R. MURRY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 109–115.—The effects of the fibre content of cane and experiments with the 18-in and 26-in dia rolls in the experimental mill are discussed. It was found that the height of a blanket of compressed cane increased linearly with increasing fibre, although there is no real evidence that the fineness of preparation depends on the fibre content since bulk density is only an arbitrary measure of preparation. Fibre has no direct systematic effect on extraction, differences in reabsorption being attributed to factors other than or in addition to the fibre. Roll load and torque both increased linearly with the fibre content. In experiments with 18-in and 26-in rolls, it was found that at roll speeds up to 60 f.p.m. the extractions were identical at the same surface speeds, i.e. roll dia. had no effect on

[1] *J. Inst. Engineers* (Australia), 1961, Jan.–Feb.
[2] MURRY: *I.S.J.*, 1960, **62**, 255.

Landsverk

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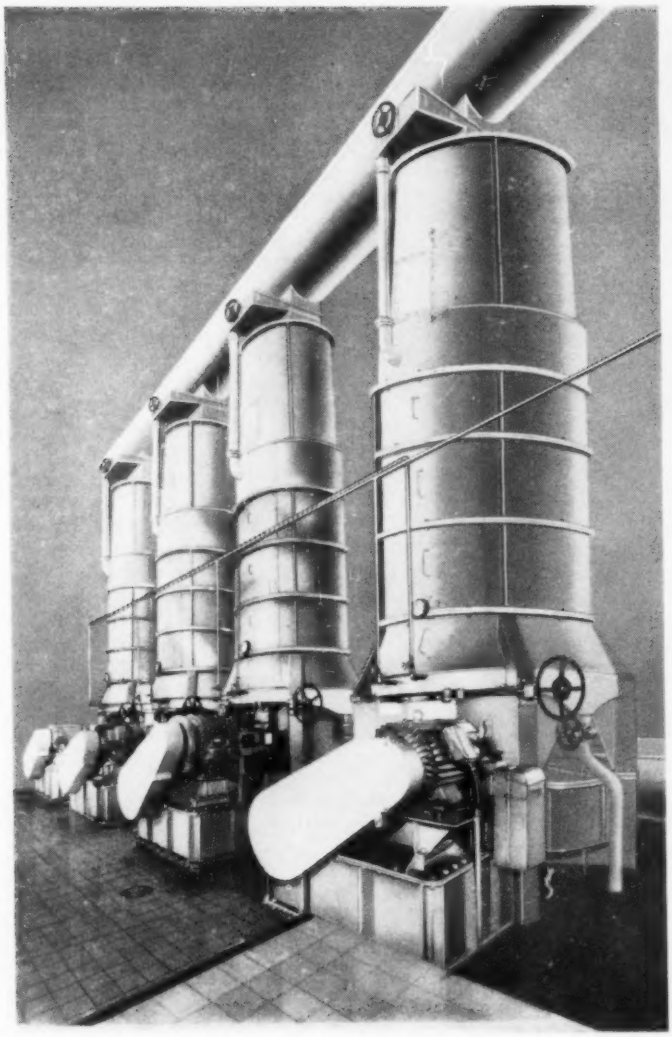

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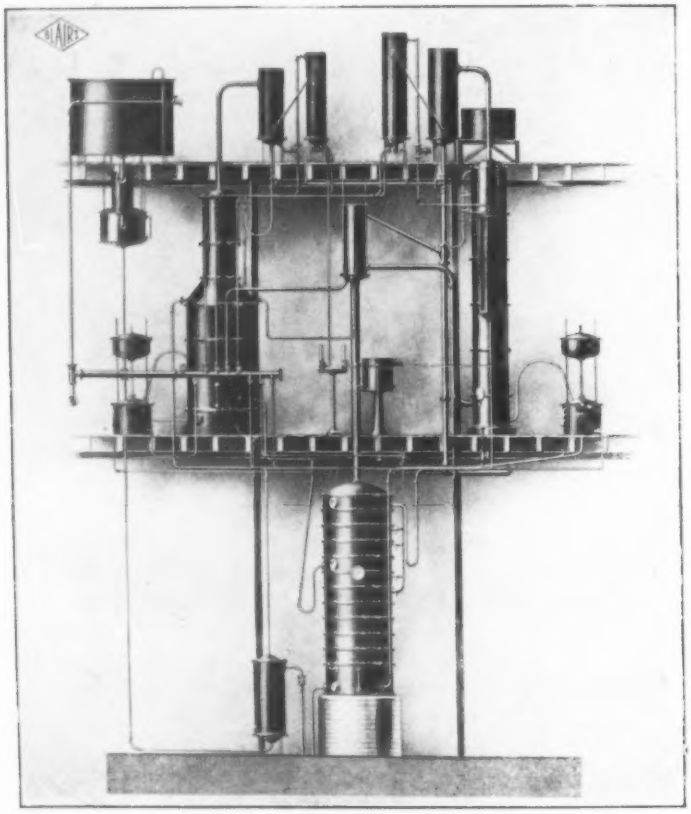

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extraction. At speeds above 60 f.p.m. the extraction with the 18-in roll dropped suddenly, probably as a result of carry-over of juice into the juice grooves before final reabsorption into the bagasse. The 26-in rolls have no juice groove scrapers, so that the juice flows to the juice tray. At identical surface speeds, the 26-in roll gave a lower re-absorption factor that the 18-in, while at identical rotational speeds the 26-in exhibited more reabsorption. The roll loads are approximately proportional to roll dia. Torque has been found to be proportional to roll load and, therefore, to roll dia. The energy consumed per ton of cane is inversely proportional to roll dia. so that in this sense, larger diameter mills are more efficient. The results have been extrapolated to a 36-in roll.

* * *

Effects of load and speed in a hydraulically loaded No. 2 mill. C. R. BAGLEY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 117–121.—Further experiments in double crushing with the 3-roll experimental mill are discussed[1]. The mill operated as a hydraulically-loaded No. 2 mill. It was found that juice extraction is independent of fibre rate at all roll loads, roll speeds and maceration rates studied. Juice and pol extraction rose with increasing maceration, the rate of pol extraction increase diminishing more sharply than that of juice extraction increase at the higher juice:fibre ratios. Both extractions increased with top roll load and decreased with increase in roll speed. There was no noticeable effect of top roll load or roll speed on mill feeding. Milling power is independent of maceration level, but increases almost linearly with the fibre rate at all top roll loads, the rate of increase being greater at the higher loadings. Power increases with roll loads and appears to be proportional to roll speed for a given roll loading and depth of feed.

* * *

The effect of fineness on the permeability of prepared cane. J. E. HOLT. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 147–149.—Tests conducted on prepared cane using the permeability cell described previously[2] are discussed. After each test the bulk density of the cane was determined after compression for 20 sec at 7·5 p.s.i. The results, plotted on log-log graphs, show a marked decrease in the permeability with decrease in the fineness of the preparation. These results show the same trend as those obtained by BULLOCK[3].

* * *

Notes on the regulation of crushing mills. W. R. CRAWFORD and J. A. MCGINN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 151–154.—The two systems of mill regulation extensively used in Australia to maintain extraction with varying crushing rates and fibre contents are described and compared. These are the Killer plate governor control of mill speed in which the signal passed to the governor is a measure of the blanket thickness in the feed hopper, and the hydraulically-loaded floating top roll and delivery roll. It has been found that where random variation in crushing and/or fibre rate occurs, the latter system is more efficient than the former. However, it is most important that the roll float freely and that it is initially adjusted so that even at the greatest downward variation in rate it does not rest on the bottom stops.

* * *

A factory milling research project. D. S. SHANN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 155–161.—A series of tests were carried out on the turbine-driven No. 2 mill and on the pressure feeder at Kalamia mill. Pol extraction increased when the top roll was made free-floating, and increased slightly more when the speed was made constant. It is pointed out that speed variation is unnecessary if the roll floats free of the stops. Load and torque variations were similar to those observed in the Sugar Research Institute experimental mill. Milling power increased linearly with fibre rate. An increase in pressure feeder torque occurring when the mill settings were reduced may be due to a slight increase in chute pressure, causing a back pressure on the bagasse leaving the pressure feeder rolls. A decrease in pressure indicated near the end of the pressure feed chute was not as great as had been predicted by previous authors. Generally, the predictions and recommendations resulting from milling research are quite valid when applied in the factory.

* * *

A mill steam turbine drive investigation. H. P. SMART. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 163–172.—Details are given of tests on the No. 2 multi-stage and the No. 3 single-stage mill turbines at Kalamia mill. It was found that with the top roll floating freely, the power requirements increased appreciably and that the original design efficiencies of both turbines were approximately 50%. The efficiency of No. 2 mill turbine dropped from 46% to 35% when the second row of blades was removed, although under these conditions it can probably develop the 520 h.p. claimed by the manufacturers. With the top roll not floating, No. 3 mill has a power consumption of approximately 250 h.p., close to that of free-floating No. 2 mill, both at fibre rates of 17 t.p.h.

* * *

Control of high grade boilings. P. G. WRIGHT. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 203–210.—Tests are reported in which a Sargeant calandria pan was fitted with Taylor b.p.e. control equipment, incorporating a vacuum control, and with a Kent recorder-controller to record and regulate the massecuite electrical resistance. A rise of 6–9°F in downtake temperature above the true b.p. and its

[1] *See also* CRAWFORD & SHANN: *I.S.J.*, 1960 **62**, 254.
[2] *I.S.J.*, 1960, **62**, 256.
[3] *Ph.D. Thesis*, University of Queensland, 1957.

effect on the b.p.e. caused instability in the Taylor control system. This difficulty was overcome by installing an internal massecuite pump and relocating the thermometer. The b.p.e. was then very close to the true value of the massecuite and could be used successfully to indicate and control supersaturation while the vacuum was maintained to within ±0·25 in Hg. However, the crystal content would still require supervision. This fact, coupled with the high capital cost of a complete b.p.e. installation, precludes recommendation of the system for batch shipment sugar boiling. The conductivity control system is preferable, since it requires less auxiliary instrumentation.

* * *

"Separan AP 30" as a clarification aid. B. D. SOCKHILL and E. T. RELF. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 211–217.—At Pleystowe the flow rate of juice through a Bach subsider varied from 10,000 to 12,500 g.p.h. and could be increased up to 16,000 g.p.h. for normal quality juices without excessive increase in turbidity. Addition of "Separan" at 2 p.p.m. on juice resulted in a flow rate of 20,000 g.p.h. with turbidity maintained at a satisfactory level. There was no appreciable increase in the level of mud in the subsider. "Separan" was not effective in eliminating particles not removed by centrifuging at 2,500 *g*. In the Killer process of secondary mud subsidation "Separan" at 5 p.p.m. resulted in improved mud settling, with a consequent increase in mud solids concentration of 50%. This allows a reduction in the quantity of mud discharged so that the overall reduction in pol loss is about 33%, equivalent to a net saving of £1700 per season at a total outlay of £660.

* * *

A statistical analysis and discussion of factors influencing filtrability. J. P. KOMEN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 219–223.—The effects on the filtrability of raw sugar of the old clarification system (4 modified conical subsiders with a total capacity of 37,000 gal) and of the new system (one 60,000-gal 5-tray Bach subsider) at Mossman mill were compared. The results of the experiments are discussed statistically. It is shown that the volume of juice to be clarified is the largest single factor in good filtrability and it is considered important to have a single clarifier for treatment of the whole juice, since control difficulties occur when several small vessels are used. In the single unit the relative distance between the mud level and juice take-off is greater. With the new system occasional "carryovers" of dirty juice were eliminated; this enabled a regular juice quality to be maintained. At identical pH values, the clear juice from the new clarifier was less turbid and contained less phosphate that that from the old clarifiers. Thus, the ratio of juice to be clarified:crushing rate is extremely important. Because of the ease of control in the new clarifier, the pH of the juice could be raised so that its phosphate concentration was lower and the sugar filtrability higher.

Relays—their application and use. R. RUSSELL. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 231–328.—The basic types of relays and variations of these are described and their applications discussed.

* * *

Some notes on air compressors. J. D. CONNOR. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 239–247.—The rotary-type compressor is discussed and compared with the reciprocating type. Its disadvantages are enumerated and the claims made on its behalf are discussed. The theory of air compression is expounded and analysis of power costs is discussed with the aid of worked examples. The importance of the true efficiency of a compressor is emphasized.

* * *

The assembly and dismantling of pressure joints by oil injection. J. C. LAW. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 249–253.—The usual method of uniting machine parts, for torque transmission, by press fitting or shrinkage has disadvantages, and the method of oil injection for joint assembly or dismantling is advocated. This is discussed, as is calculation of the factors relevant to torque transmission and assembly tool design.

* * *

A new fuel gas for Australian industry. H. R. THOMAS. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 255–260.—The properties of propane, now available in increasing quantities in Australia as a result of the development of oil refineries, are described and its applications discussed, particularly those in which it enjoys advantages over acetylene.

* * *

The applications of mechanical lubrication to the sugar mill. A. G. CUMMING. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 275–283.—Selection of the lubricator unit is discussed and oil-type and grease type lubricators are described. The positive feed distributor which enables minor feed points to be mechanically lubricated is also described. The use of flow indicators in conjunction with lubricators and the lubrication of conveyor chains are also covered.

* * *

Steam take-off from mill boilers. C. J. ALLAN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 285–287.—The effects of fluctuations in boiler load on steam generation are discussed. Devices for ensuring satisfactory steam quality are described, including cyclones in the boiler drum and external cyclones (made from steam piping).

* * *

Improving evaporator performance at Proserpine mill. J. D. PERRY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 289–291.—Details are given of the alterations and additions made to the original quadruple-effect evaporator (now quintuple-effect

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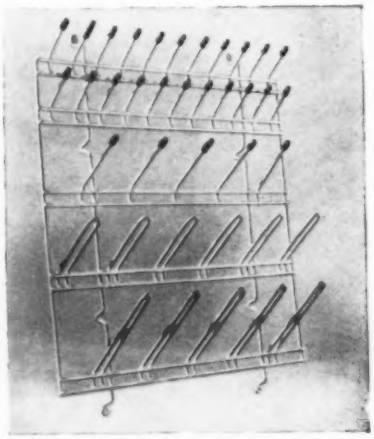

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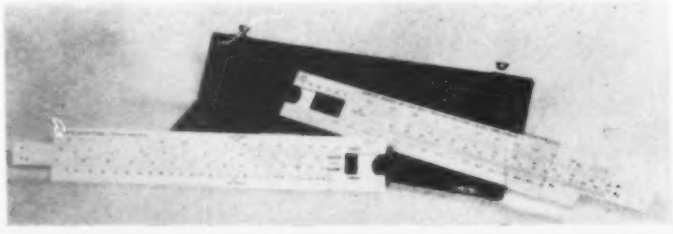

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with pre-evaporator). The modifications include enlarging of the vapour pipes, installation of an "under-under" feed system, increasing the number of incondensable gas vent-pipes to 17 per calandria, and installation of a level control to maintain optimum liquor level in the 5th effect.

* * *

New subsider for Millaquin. C. J. ALLAN and A. P. SARANIN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 293–298.—Details are given of a projected subsider, the design of which is based on existing types. It incorporates two mud trays, with a Fitch-type feed entry which provides two opposing vertical currents of juice which enter tangentially a circular inlet chamber above the centre of the subsider. The two streams pass around the inlet chamber and the clear juice flows down the central well. The central feed is graduated and multiple ring-type juice withdrawal is used.

* * *

The performance of a mechanical draught cooling tower. P. G. ATHERTON. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 299–305.—Details are given of a twin-cell, single-cross-flow, induced-draught cooling tower installed at Kalamia mill.

* * *

The removal of insoluble impurities from B molasses. C. SIMPSON and R. DEICKE. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 307–315.—Factory trials carried out at Fairymead on the removal of insoluble mud impurities from *B* molasses in Westfalia centrifuges are discussed. The centrifuges used were a nozzle type with recycling of the concentrate, and a continuous, automatic desludging centrifuge. The results indicate the suitability of the latter, with an optimum capacity of 850–900 g.p.h. of 70° Bx molasses at 170°F, although strict Brix and temperature control are necessary to achieve maximum performance. The results suggest that some reduction in final molasses purity would result, and possible improvement in shipment sugar quality. The loading on the low-grade station would be eased, as 5% of the molasses is discarded as sludge.

* * *

Development and operation of the ring-type pan. E. G. CLARKE. *Sugar J.* (La.), 1961, **23**, (11), 33–37. Details are presented of a ring-type pan installed at Savannah refinery for white sugar boiling. The pan is fully automatic from raising of the vacuum to dropping of the strike, with the control system operated from a central control room. The primary control is of the sequence type, while the secondary control is of the "cascade" type. Boiling time is adjustable from 70 to 120 min. The advantages of the ring-type pan over the coil pan are enumerated. The costs of extra equipment for heavy boiling are high but improved yield and fewer boilings are hoped to cover these.

Design of coil and calandria vacuum pans. C. G. M. PERK. *S. African Sugar J.*, 1961, **45**, 327–339.—A survey is presented of coil and calandria vacuum pan design, with a discussion of incondensable gas venting, dimensions, ratio of heating surface:volumetric capacity, vapour outlet diameters, etc. The advantages and disadvantages of the coil pan are discussed as is the question of the requirements of the calandria pan to enable it to use vapour instead of exhaust steam.

* * *

The performance of sugar factories in 1960. J. DUPONT DE R. DE ST. ANTOINE. *Mauritius Sugar Ind. Research Inst. Rpt.*, 1960, 89–93.—Average figures for rainfall, cane crushed, sugar produced, milling results, etc. are given for 1960 when 235,589 tons of sugar were manufactured by the 23 factories. The low sucrose content of the cane is attributed to cyclone damage, milling of immature shoots, exceptionally high September rainfall, and indirect effects of the cyclones. The cane fibre content was high and the average mixed juice purity low at 83·5. Clarification of the juice from the damaged cane presented no difficulties, although the lime consumption and consequently the massecuite and molasses viscosities were high. Boiling time was extended and the average crystal content % Brix of *C*-massecuite was 33·2 compared with 35·3 in 1959. Molasses purity averaged 37·2 as against 36·7 in 1959.

* * *

The use of crystallizers for the cooling of high-grade strikes in raw sugar manufacture. J. P. LAMUSSE and M. RANDABEL. *Mauritius Sugar Ind. Research Inst. Rpt.*, 1960, 97–98.—Experiments were carried out to determine the extent to which cooling of *A* and *B* massecuites affected the crystal content and purity drop from massecuite to molasses. The results showed that cooling of these massecuites in crystallizers before spinning gives a purity drop higher by 6·2 units for *A* massecuite and by 4·4 units for *B* massecuites than for massecuites spun without cooling, while the crystal content was 7·4% higher and 5·3% higher for *A* and *B* massecuites respectively. Reasons for the preference in Mauritius for cooling rather than boiling back are enumerated.

* * *

The influence of magma purity on volume of *C*-massecuite and on recycling of final molasses. J. DUPONT DE R. DE ST. ANTOINE. *Mauritius Sugar Ind. Research Inst. Rpt.*, 1960, 98–100.—The magma purity in many Mauritian factories, where the *C* sugar is single-cured, mixed with syrup and used as footing for the *A* and *B* strikes, has been very low in recent years (81–82 purity). The effect of decreasing magma purities on the quantities of *C* massecuite and of recycled final molasses is calculated and discussed. From a graph of the results an equation is derived which may be used for calculation of the amount (kg) of molasses solids recycled per hour (*M*) in a factory crushing 100 tons of cane per hr for *C* sugar purity (*P*) of e.g. between 70 and 90. This takes the form $\log M = \frac{150 - P}{24{\cdot}25}$.

BEET FACTORY NOTES

A method of pre-limed juice filtration. Results obtained at Notre-Dame Refinery, Oreye. E. DORMAL. *Sucr. Belge*, 1961, **80**, 353–383.—The juice purification scheme described earlier[1] was applied at Oreye during the 1959 campaign and the results obtained in 1959 and in the 1960 campaign are described. Carbonatation in the pre-limer in 1959 was irregular and it was concluded on the basis of laboratory tests on the effects of under- and over-carbonatation on settling (% mud and F_ϵ) that it would be better to separate the preliming and carbonatation stages; this would also facilitate automatic pH control of the latter. The ultra-thickener behaved as expected, while sucrose losses in the rotary filter muds could only be kept at the acceptable level by reducing the throughput to 75% of that calculated on the basis of the pilot plant trials. Examination of outlets for the flocculate showed that only up to 25% could be incorporated into pulp for fodder, its use as fertilizer was uneconomical and its use as a soil conditioner very limited; it was decided to return the $CaCO_3$ concentrate to the 4th compartment of the prelimer, sending all the muds to the ultra-thickener and rotary filter. This scheme, adopted in 1960, was entirely satisfactory, as indicated by the detailed results given in tabular and graph form and discussed in detail, together with savings in limestone, coke, filter cloth, coal, labour, etc.

* * *

The 1960/61 campaign. F. SCHNEIDER. *Zucker*, 1961, **14**, 258–264.—The molasses composition from the 1960/61 campaign is compared with that from 1959/60 and with average values from earlier campaigns. These show that the molasses purity was about 1 unit lower than the average (but higher than for 1959/60). The advantages and disadvantages of processing cold raw juice are discussed. The use of "wiped" glass electrodes is recommended for pH measurement during 1st carbonatation in the Braunschweig juice purification scheme; after 48 days' immersion an electrode still gave the same reading, i.e. the true pH, which at 20° C was one unit lower than at carbonatation temperature. However, with 2nd carbonatation juice, the electrode must be treated with acid every 2-3 days to maintain its sensitivity, because of the high $CaCO_3$ content in the juice. Mud sweetening-off by decanting in counter-current has been found to have so many disadvantages that it is not recommended. Formulae are presented for calculation of the volume of juice when sludge juice or thickened sludge is recycled and for control of the thickening-up process in clarifiers. In the after-product processing the possibility is suggested of calculating the molasses purity from the non-sugar composition. The effect of the non-sugar:water ratio during mingling is also discussed. Waste water problems occurring when ion-exchangers are used have been investigated and tests with an "Aero-Accelerator" waste-water treatment device are reported. Since the residual BOD_5 of the treated water was still 600 mg/litre (normal factory waste water has a BOD_5 of 2000 mg/litre), the equipment is not recommended.

* * *

Washing by atomizers of the layer of mud on vacuum filters. I. A. ROSTRIPENKO. *Sakhar. Prom.*, 1961, (5), 9–11.—Tests with atomizers for sweetening-off vacuum filter muds have proved the superiority of these over the conventional jet sprays. The atomizer system consists of a water supply feeding branch pipes at regular intervals. The upper ends of the water pipes meet branch pipes of an air feed at an angle of 85°. Compressed air at 1–0·5 atm atomizes water flowing through the pipes and directs it onto the muds. Residual sugar content was 0·017–0·02% lower on weight of beet in a 7-mm cake, while water consumption was 30% lower with atomizers than with the jet sprays. Other advantages of the system are given.

* * *

Experience in the operation of an Olier diffuser at Korenovsk sugar factory. I. A. KRIKSIN. *Sakhar. Prom.*, 1961, (5), 15–17.—The rather high losses incurred in operation of an Olier diffuser with a daily throughput of 2500 tons of beet (0·9%, varying from 0·5% to more than 1%) are attributed to irregular packing of the cossettes between the screens, again resulting from pressing of the cossettes by the screens in their transfer from one column to the next. Other defects are noted, mostly structural. At full capacity, the water pressure in column 4 was inadequate. The diffuser capacity was only 30% of the rated capacity.

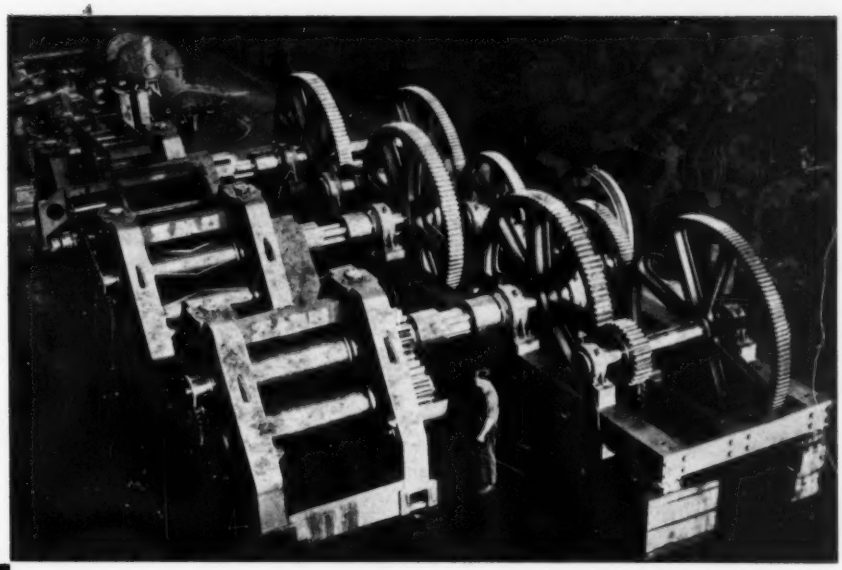
* * *

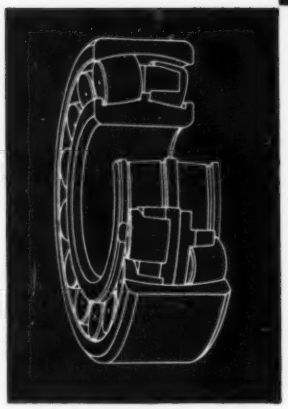
Control of the operation of multi-tray clarifiers for carbonatation juice. M. I. BARABANOV. *Sakhar. Prom.*, 1961, (5), 35–37.—Control of clarifier and vacuum filter operation necessitates not only a knowledge of the temperatures, s.g. of the mud suspension and turbidity of the supernatant liquor, but also the amount of mud suspension and clarified liquor removed from the clarifier. Simple equations are developed for calculation of these two factors.

* * *

Construction of the Zeil factory of Zuckerfabrik Franken G.m.b.H. H. MATHEIS. *Zucker*, 1961, **14**, 288–302.—Full structural details are given with plans and photographs of the new factory built at Zeil to process that quantity of excess beet which Ochsenfurt could not conveniently process. Besides a description of the beet reception arrangement, the white sugar silos are mentioned. The four tower silos are grouped in clover-leaf formation, so that a fifth silo is formed by the centre, giving a total storage capacity of 27,000 tons of white sugar.

[1] *I.S.J.*, 1960, **62**, 101.





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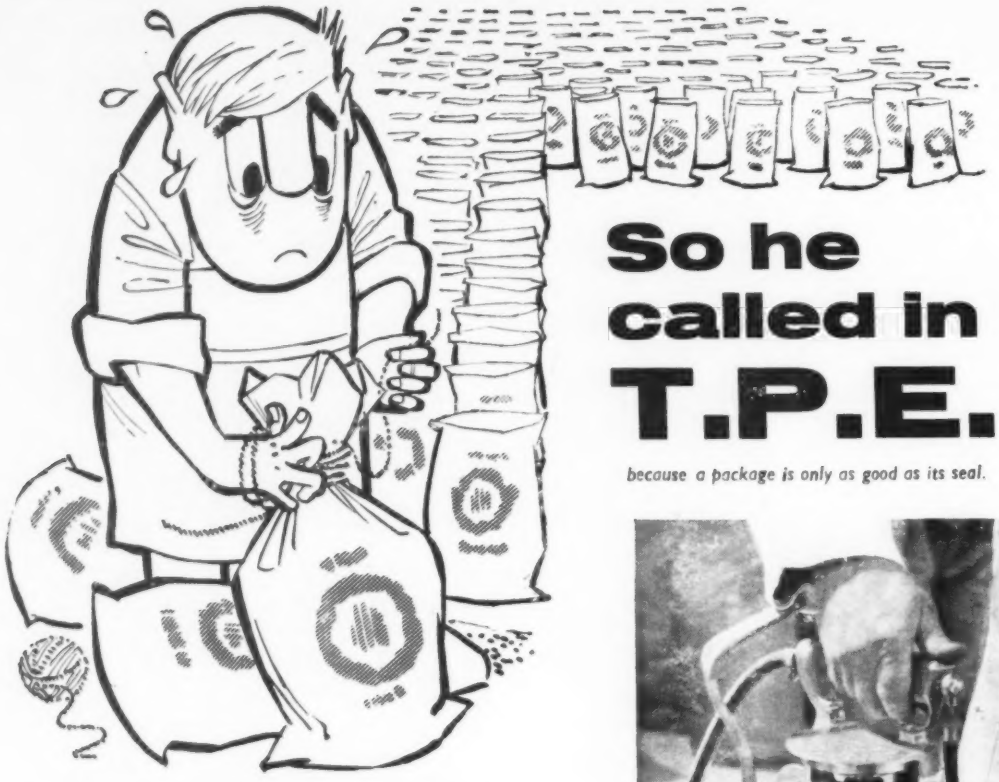

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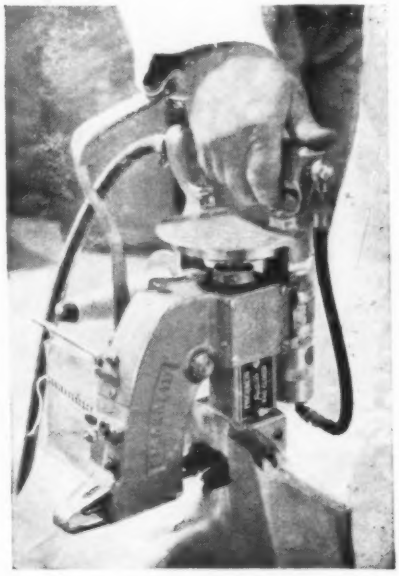

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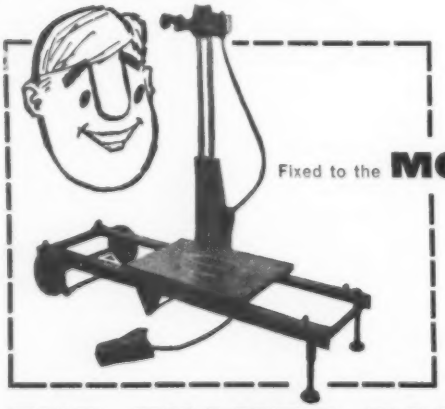

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Construction, equipment and start-up of the Zeil (Main) sugar factory of Zuckerfabrik Franken G.m.b.H. K. SCHNEIDER. *Zeitsch Zuckerind.*, 1961, **86**, 313–325.—Details are given of the construction and equipment of the white sugar factory, which ran its first campaign in 1960/61. Among the more important pieces of equipment are two BMA tower diffusers, 5 Buckau-Wolf evaporators, 9 pans for *A*, *B* and *C* products, 10 automatic batch conical *A* centrifugals and 4 push-type *B* centrifugals and 10 after-product centrifugals (semi-automatic with manual discharge). In the coming year 3 further fully-automatic centrifugals are to be installed for raffinade and one for after-product. Ceramic candle filters are employed. The melt station is supervised by one man who also supervises the Quentin ion-exchange plant for molasses treatment. Details are given of the controls. In the first campaign the daily slice was 3400 tons of beet. Diffusion losses were 0·21% at a juice draught of 116%. Molasses purity was 59·3%. (See also previous abstract.)

* * *

The mechanism of sugar extraction from beet cossettes. W. RATHJE. *Zeitsch. Zuckerind.*, 1961, **86**, 326–327.—Model tests are described in which a vessel consisting of a cellophane membrane stretched over a glass ring was filled with a solution of 0·1N rubidium chloride and various quantities of sucrose added. The vessel was immersed in 1 litre of 0·1N KCl solution until the levels of the inner and outer liquids were identical. The solutions were stirred. Samples (0·5 ml) were withdrawn every 4 hr and the potassium and rubidium concentrations determined by flame photometer. The volumes of liquid in the vessel at the start and end of the tests were determined by weighing. In the absence of sucrose and at identical fluid levels no fluid passed through the membrane. With increase in the hydrostatic pressure (created in the space between the top of the vessel and the outer fluid), the inner solution was forced through the membrane, while with increase in osmotic pressure (increasing sucrose concentration) of the inner fluid, the outer fluid passed through the membrane. The outflow and inflow of the two fluids was identical. One half of a beet was water-extracted at 78°C with 100 volumes of water for 1 hr, while the other half was treated at 78°C with a 15% sucrose solution. The halves were immersed in water at 78°C for 30 min and ethanol added. Slices (1 mm) were then cut from the halves and the ethanol content determined after weighing. It was found that the cossette containing the sugar also contained more ethanol than the other, sugar-less, cossette. Similarly-treated cossettes, immersed in water to which 2% H_2S was added, were sliced and the slices immersed in lead acetate solution. The sugar-free cossette was blackened only at the edges, while the sugar-containing cossette was completely and almost uniformly blackened by the lead sulphide. The fluid exchange noted in these tests is thought to be possibly responsible for the rapid extraction of sugar from cossettes during diffusion.

Determination of the capacity of white sugar centrifugals. K. PAUSE. *Zeitsch. Zuckerind.*, 1961, **86**, 328–330.—For the separation of crystals and run-off in a white sugar massecuite, for spinning-off the wash syrups and for dry spinning of the sugar, a certain amount of work must be accomplished which is proportional to the product of spinning effect × working time and which has been measured in "effect seconds." Should the number of "processes" per hr be increased, so must the number of revolutions be increased to the maximum possible. With higher spinning effect the wash water consumption is lowered. By installing high torque motors, the centrifugal capacity may be increased and the yield improved.

* * *

Experience with RT diffusion at Čejetičky sugar factory. A. KOVARIK and R. OSVALD. *Listy Cukr.*, 1961, **77**, 127–130.—Details are given of the "Regula" control system installed in 1959 to control cossette feed, juice draw-off, hot and cold water addition to the diffuser, the hot water temperature and the temperature of the circulation juice. Diffusion performance data are also presented for the 1959/60 and 1960/61 campaigns. Losses were 0·446 and 0·317% sugar in pulp at juice draughts of 109·6 and 112·4%. Retention time was 89 and 96 min, with an average throughput of 1000 tons/day. The diffuser worked smoothly and maintained its capacity even with treatment of poor beet. Apart from the low losses, its advantages are stated to be low juice draught and low power consumption. Its defects include large dimensions and little use of working space. No effect of the diffuser on the quality of raw juice nor on molasses sugar content was established.

* * *

Decolorizing remelt sugar at Witaszyce sugar factory. K. KOPERA and A. JARZECKI. *Gaz. Cukr.*, 1961, **63**, 146–149.—A station of 4 ion-exchange columns is used for decolorization of remelt sugar, with "Asmit 259" as resin. *C* sugar is affined and centrifuged together with *B* massecuite, melted and treated with active carbon and filtered. Part of this melt is then treated by ion-exchange and mixed with thick juice for preparation of *A* massecuite. A decolorizing effect of 68% was attained (campaign average), the colour being reduced from 18·9°St/100 Bx to 6·04°St /100 Bx. Details are given of the regeneration with HCl and NaOH. For optimum ion-exchange effect, the melt colour should not exceed 10–12°St.

* * *

Periodic-continuous diffusion and waste water purification. R. KRAJEWSKI. *Gaz. Cukr.*, 1961, **63**, 149–150.—To eliminate diffusion water, press water and highly coloured water from the factory waste water scheme, a diffusion process is suggested which includes a batch diffuser, a mixer-separator for the cossettes, and a continuous diffuser for further treatment of the pulp. A reduction in sugar losses is claimed as well as an increase in throughput.

NEW BOOKS AND BULLETINS

Home-grown Sugar. ANON. 56 pp; 5½ × 8¼ in. (British Sugar Corporation Ltd., 134 Piccadilly, London W.1.) 1961.

This year sees the 25th Anniversary of the Act of Parliament which produced the amalgamation of all the beet sugar factories in Britain, and is thus the Jubilee year of the British Sugar Corporation. This booklet, issed at such a time, provides a history of what the subtitle calls "The rise and development of an industry"—a concise factual account of the Corporation and the home-grown sugar industry. A brief introduction is given to the nature and history of sugar production to the Napoleonic period, as well as an account of the pioneering efforts at production of home-grown sugar. The subsidy system of 1924–35, the work of the Greene committee and the Act of 1936, which brought the Corporation into being, are discussed. The effects of World War II and post-war conditions on the organization of the industry are described, culminating in the Sugar Act of 1956. Modernization of the factories after their severe over-working during the War was carried out, subsequent capital expenditure bringing the total cost to well over £14 million. Agricultural aspects of the industry are discussed as are the factory process and the marketing of sugar in Britain. Statistics of beet crops and sugar outturns are provided, with a variety of photographs. The book closes with a most useful index.

* * *

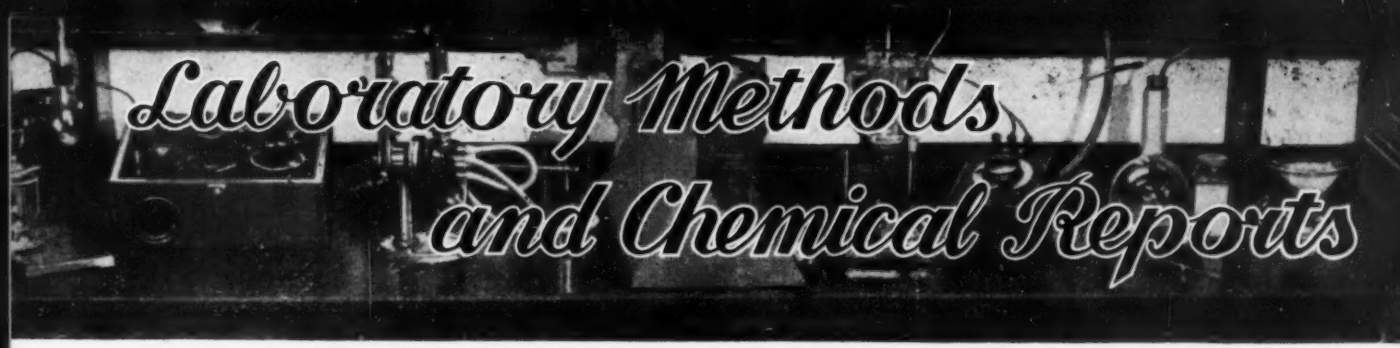
Beet Sugar Factories of the United States. 27 pp; 8 × 10½ in. (Sugar Divn., Commodity Stabilization Service, U.S. Dept. of Agriculture, Washington 25, D.C., U.S.A.) 1961.

This book is a revision of a previous work and contains information up to March 1961. It provides a year-by-year history of the beet sugar factories of the U.S., the first of which was installed at White Pigeon, Mich., in 1838 but dismantled in 1840. After this chronology are tables of factories erected and removed, factories in existence in March 1961, states in order of daily slicing capacity of factories (California and Colorado at 30,350 and 26,750 tons/day being well ahead of the third state, Idaho, at 15,900 tons/day), and beet sugar companies with their factories.

* * *

Voprosy razvitiya sakharnoi promyshlennosti. (Problems in the development of the sugar industry.) 102 pp.; 5¾×8¾ in. (Izd. Akad. Nauk Ukrain. SSR, Kiev, U.S.S.R.) 1961. Price: 48 kopek; 7s 0d.

This volume contains papers read at the 1958 Conference on the Development of Productive Forces in the Khar'kov Economic Region, one of the largest regions of the Ukraine, which produces two-thirds of the total sugar production of the Soviet Union. P. N. SHEMYAKIN discusses the problems of beet storage and advocates the following steps: piling the beet as quickly as possible after harvesting with coverings of corrugated paper treated with solar oil together with straw mats (3 layers of paper + 2 layers of straw mats) rather than covering with earth; ventilation with forced air; covering with snow in the case of long storage periods; and generally improving the organization at beet reception yards. The author maintains that beet growth in the pile is insignificant as far as losses are concerned, as opposed to rotting and freezing of the roots. B. A. EREMENKO and B. G. SUSOROV discuss with the aid of a flow diagram a scheme for automatic control of the processes in the beet factory, drawn up by TsINS in 1956 and which co-ordinates all schemes suggested for each process with subsequent modifications. The Stalin factory is put forward as an example of a factory where the processes up to carbonatation have been made automatic and where further automatic controls are being developed. Among the factors determining factory performance, YA. M. BYATETS discusses the work of each section (battery diffusion, juice purification, evaporation, pan boiling and crystallization) and recommends certain measures which would bring about increased factory throughput. His detailed observations are based on the results obtained at a number of factories in the Poltava beet sugar group. P. V. GOLOVIN and A. A. GERASIMENKO advocate the use of 4-stage ion-exchange for treatment of 2nd carbonatation juice, in which the juice at 20°C is passed through cation-anion-cation-anion exchange columns to give a purity of approximately 96–98, raising the sugar yield by 1–1·3% on weight of beet. G. A. KHOMCHUK discusses the Steffen process and emphasizes that the importance of the Steffen plant lies not only in the increased sugar yield, but in the other valuable products obtained from the molasses. A. P. PONOMARENKO discusses increasing diffusion juice draught as the only way remaining in which to increase sugar extraction and reduce losses. However, this will lead to an increase in fuel consumption unless the fuel system is modified. The performance of an evaporation station is discussed mathematically with a quadruple-effect evaporator as example. The measures adopted at the Stalin factory to effect steam economies are described. These include the compression of 1st effect vapours which are then re-used to heat that same effect. Boiling-out of individual effects while the evaporator is in operation enables the heating system of the evaporator and steam consumption to be maintained constant. Water used in factory processes and waste water economy are discussed by A. F. CHEKURDA. Flow diagrams are presented for two schemes of water supply and usage, diffusion and press water purification and waste water purification and re-use. For the Khar'kov factories he advocates certain measures including the introduction of new equipment for waste water treatment and the construction of tanks, ponds, etc. By these means fresh cold water consumption may be reduced by ¾–⅞ and class III waste water by ¾–⅞ compared with typical optimum schemes.



Influence of non-sugars in beet, particularly on molasses formation. II. Effect of individual non-sugar fractions on molasses formation. F. SCHNEIDER, E. REINEFELD and F. AMDING. *Zucker*, 1961, **14**, 234–237.—The effect of the N and salt fractions separated from molasses by ion-exchange treatment[1] on sucrose solubility and on crystallization was studied. Graphs are presented showing the increase in sucrose solubility with rise in temperature at constant N content and salt content. With increasing salt content below 60°C and with increasing N content in the syrup, the solubility fell initially, but later increased, the respective N and salt concentration at the minima decreasing with increasing temperature. In the presence of both N and salt fractions, the effects on sucrose solubility are additive.

* * *

Evaluation of beet according to the conductimetric ash and noxious nitrogen content. W. KRÜGER. *Zucker*, 1961, **14**, 238–243.—Laboratory tests were conducted on fresh cossettes and the corresponding thick juices (from factory raw juices) to determine the relationship between conductimetric ash in press juice[2] and ash in thick juice and between the noxious N[3] in the beet and the total N in the thick juice. Despite marked scattering of the values, clear relationships were established. Differences between white sugar yield and beet pol (corrected and uncorrected) were calculated according to LÜDECKE[4] and the results compared. They indicate the positive effect on molasses formation of noxious N, which must therefore be considered as well as conductimetric ash in beet evaluation.

* * *

Crystallization of sucrose in the presence of potassium chloride. G. MANTOVANI. *Ind. Sacc. Ital.*, 1961, **64**, 73–82.—Commercial white sugar was recrystallized from conductivity water containing pure Na_2CO_3 to maintain an alkaline pH and prevent inversion. The product contained 0·032% ash and 0·007% reducing sugars. Single crystals suspended from a fine thread were grown in sucrose solutions containing 5, 10 and 20% KCl (also recrystallized from conductivity water), maintaining at 25° ± 0·1°C, and replacing the mother liquor at 20-day intervals. This maintained the supersaturation at 1·10, calculated by means of the NICHOLSON & WISE data[5]. When the crystals had grown to a suitable size they were separated and washed in ethanol. Small crystals which had formed at the bottom of the vessel were also separated, washed with conductivity water and with alcohol. Measurement of the crystal faces and axis ratios indicated no morphological change induced by the KCl. Rates of crystallization were measured by weighing crystals suspended in the sucrose/KCl solutions before and after a 100 min interval. The weights were corrected for buoyancy and the growth rate calculated by the formula of KUCHARENKO. The rate was not significantly affected by the presence of KCl, while the technique proved to give good and reproducible results. The large single (7–32 g) and small crystals (0·1 g) were analysed for KCl using a potentiometric technique, and it was found that only small amounts were retained in the former (about 25 p.p.m.) although larger proportions were found as the result of inclusion where small crystals grew together. Washing of a large crystal showed the KCl content to be uniform throughout.

* * *

Calculations of recoverable sugar from sucrose content of cane in experimental plots. J. DUPONT DE R. DE ST. ANTOINE and P. HALAIS. *Mauritius Sugar Ind. Research Inst. Rpt.*, 1960, 103–105.—For agronomic or other studies at the Institute, industrial sucrose % cane is to be taken as 0·9 SC, where SC = sucrose % cane, and industrial recoverable sucrose % cane as (0·9 SC − 1·8).

* * *

Effect of non-sugars in beet, particularly on molasses formation. III. Classification of non-sugars. F. SCHNEIDER, E. REINEFELD, and A. EMMERICH. *Zucker*, 1961, **14**, 307–311.—Molasses exhaustion and thus the molasses purity may be predicted from the non-sugars composition of thick juice for a given degree of evaporation (non-sucrose/water) and a given temperature without knowing the concentration of any given non-sugar. The non-sugars for this purpose are divided into two fractions: alkali ions and the remaining non-sugars. A clear linear relationship is established: (non-sugars − alkali ions)/alkali ions = $\frac{\text{non-sugars} - (1{\cdot}9\ \text{ash} - 2{\cdot}5\ CaCO_3)}{\text{ash} - CaCO_3}$. The dependence of molasses purity on the factor on the right-hand side of the equation is plotted with a straight-line graph. Hints are given on beet breeding based on the results of these tests. For an accurate prediction of molasses purity, the beet must be processed to thick juice at least. Press juice alone will give satisfactory results only under special circumstances, and then with a lower accuracy.

[1] *See* SCHNEIDER *et al.*: *I.S.J.*, 1960, **62**, 229.
[2] TÖDT: *Zeitsch. Ver. Deutsch. Zuckerind.*, 1925, **75**, 429–439; *I.S.J.*, 1925, **27**, 503.
[3] STANEK & PAVLAS: *Zeitsch. Zuckerind. Czech. Rep.*, 1934, **59**, 129–141; *I.S.J.*, 1935, **37**, 114.
[4] *Zucker*, 1954, **7**, 328.
[5] *Proc. 9th Congr. I.S.S.C.T.*, 1956, 329; *I.S.J.*, 1956, **58**, 329.

An examination of the effectiveness of various sanitizing agents against yeasts isolated from liquid sugar and sucrose-corn blends. P. S. NICHOLES and F. C. BURTON. *J. Amer. Soc. Sugar Beet Tech.*, 1961, **11**, 399–405.—Bacteriological and mycological problems have arisen in association with the preparation and distribution of liquid sugar and sucrose-corn syrup blends. Yeasts have been isolated growing at sugar-blend concentrations of 72–75°Bx. Tests were conducted on various commercial germicides with the aim of determining their effect on 3 different types of yeast isolated from liquid sugar products and of comparing their efficiency under laboratory conditions. It was found that "Hymine 3500" (quaternary ammonium compound) and "Weladyne" (iodine compound) were particularly active, even in the presence of sucrose, which, however, did reduce their efficiency by increasing the time taken to kill the bacteria. The sucrose affected the "Weladyne" less than it did the "Hyamine." Both compounds in aqueous solutions deteriorated on standing, the rate of deterioration increasing with temperature increase. While the iodine compounds are less stable than the quaternary ammonium compounds, they have the advantage of a built-in indicator, presenting a visual aid to a study of bacterial activity.

* * *

Measurement of colour by means of the Lange colorimeter and calculation of °Stammer from extinction values. K. SUNGUR. *Seker*, 1961, **10**, (39), 13–17.—Experiments using the Lange and Stammer colorimeters during the 1960 campaigns are described, and a graph constructed for conversion of Lange extinction values to °Stammer and *vice-versa*. This is based on the formula: $°St/100\ Bx = \frac{Ext/100\ Bx.}{2{\cdot}12}$

* * *

The dependence of marc content on pol. L. SCHMIDT and M. FRIML. *Listy Cukr.*, 1961, **77**, 137–138.—From mean values, obtained over the period 1951–60, of beet pol and marc content, the trend in the rise of pol and marc content has been determined. An equation is developed showing the dependence of marc content (y) on pol (x): $y = 0{\cdot}1167\,x + 2{\cdot}5546$. It has been found that a 1% rise in the sugar content corresponds to a 0·12% rise in the marc content and to a 1·62% rise in the yield of pressed pulp. The suitability of the equation is confirmed by determination of the marc content of different varieties of Czechoslovakian beet.

* * *

Quantitative relations between the constituents of true molasses. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Gaz. Cukr.*, 1961, **63**, 97–105.—A previously described method of solubility determination[1] was used to determine the dependence of the solubility of sucrose in impure solutions (R) on the non-sugars:water ratio (A). It was found for values of A higher than 1·5 that the saturation coefficient (Wn) (ratio of $R:r$, where r = sucrose solubility in water) is always a linear function of A, expressed by $Wn = mA + b$, where m and b are constants. At $A = 7{\cdot}0$ there is no critical breakpoint if the measurements are made at a suitably high temperature and the solution is of moderate viscosity. Thus, in theory, within the limits 1·5 and 7·0, crystallizable sugar may still be extracted from "true" molasses (described by CLAASSEN as intercrystalline syrup from which no sugar may be crystallized before further thickening or cooling) by evaporation or cooling. In practice, however, crystallization is limited by the viscosity; 40 poises is considered normal, while the maximum is about 500 poises. In the equation $R = r(mA + b)$, which applies where A is greater than 1·5, m and b are independent of water and sugar content as well as temperature in a saturated solution at a given non-sugars composition. Thus solubility curves may be drawn from two solubility determinations over the whole temperature and concentration tange. Appropriate formulae are derived and graphs and nomograms drawn of the parameters for different Polish factories.

* * *

Ion-exchange method for determining cations and the ash content of sugar products. S. ZAGRODZKI and H. ZAORSKA. *Roczn. Technol. Chem. Zywnosci*; through *J. Sci. Food Agric. Abs.*, 1961, **12**, i–288.—The sum of K, Na, Ca and Mg ions of the sugar product is taken as the basis of sugar ash calculations. The sample solution is passed through an ion-exchange column filled with a polystyrene resin containing active SO_3H groups and treated with aqueous NH_3. The K and Na ions are extracted with $(NH_4)_2CO_3$, and are later determined by titrating the extract with HCl. The Ca and Mg ions are extracted with 25% aqueous NH_3 portionwise, and are determined by titrating a known amount of EDTA (disodium salt) solution with the second extract. The Fe or Al ions, if present, are individually determined in the second extract. The new method takes only 90 min, and after the second extraction the ion-exchange column is ready for the next determination. The carbonate or sulphate ash content can be calculated from the titrations.

* * *

Refractometric determination of molasses standard purity. CH. I-SYAN'. *Sakhar. Prom.*, 1961, (6), 31–32.—The method described by AKINDINOV[2] for calculation of molasses sugar content at standard purity has been found to give results which agree very closely with experimental results. However, if the crystals are not completely dissolved before analysis, the results will be too high. The fact that an error of 0·1% in the refractometric determinations corresponds to an error of 0·3 units in the purity figure is considered a serious defect.

[1] WAGNEROWSKI *et al.*: *I.S.J.*, 1960, **62**, 225.
[2] *I.S.J.*, 1960, **62**, 224.

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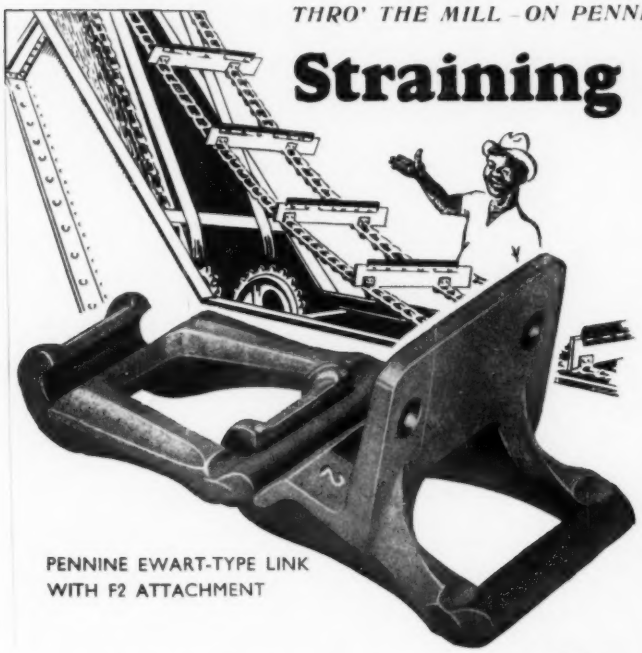

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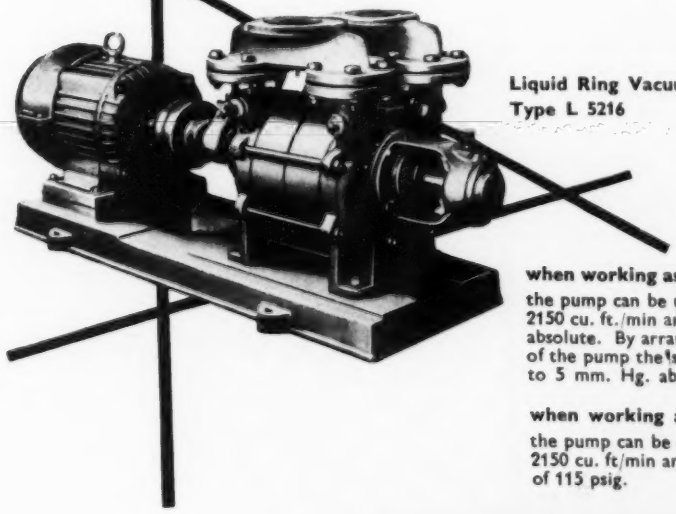

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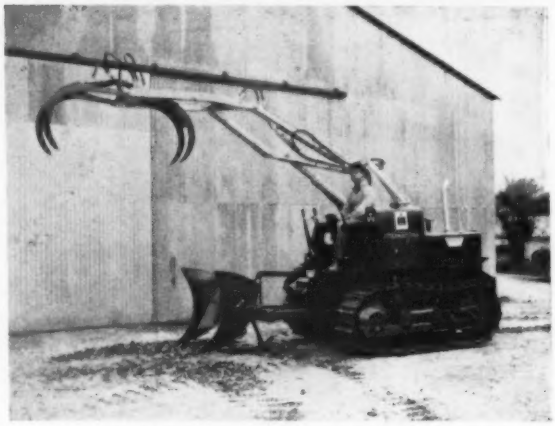

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Partial esterification of carbohydrates. H. H. SZMANT, E. P. OLAVARRÍA and Y. VAILLANT. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 149–154.—The literature on the preparation of partial esters of mono- and disaccharides with carboxylic acids is reviewed with 30 references. The authors have prepared, by alcoholysis, a number of mono-esters of α-methyl-D-glucopyranoside, their analysis and melting points being reported. Separation of sucrose mono-and di-stearates as urea complexes is described.

* * *

Study of the influence of concentration of sucrose on the acetone-butanol fermentation by different strains of *Clostridium*. K. BAHADUR and K. K. SAROJ. *Proc. Nat. Acad. Sci. India*, 1959, **28A**, 87–96; through *S.I.A.*, 1961, **23**, Abs. 132.—Eight strains of *Clostridium* were cultured for 20 days on an inorganic medium containing 5, 10 or 20% of added sucrose. Total sugar, reducing sugars, butanol, acetone and total and volatile acids were determined in the residual solutions, and the results are tabulated. The optimum concentration of sucrose for butanol production was 5%; a maximum yield of 96% of butanol on sucrose was obtained with *C. butylicum* IZ. (380) IAL (15–152).

* * *

A process for S-2 bagasse hard board making. C. I. NEE and W. C. HSIEH. *Rpt. Taiwan Sugar Exp. Sta.*, 1960, (21), 57–80; through *S.I.A.*, 1961, **23**, Abs. 138.—The process, patented in Taiwan and operated at Changhua Bagasse Board factory, is described and discussed in detail. The product, ⅛ inch in thickness and smooth on both sides, conforms to the U.S. Federal Specification for structural hard-pressed fibre-board. De-pithed bagasse (100 parts) and added water (66–160 parts, adjusted to give 68–72% water in the cooked bagasse) are cooked in a rotary digester with steam under pressure, in order to soften the bagasse without destruction of lignin. The normal cooking cycle comprises steaming at 60 p.s.i. (gauge) for 13 min, a relief period at 11 p.s.i. for 7 min, steaming at 90 p.s.i. for 80 min, and digestion at 90 p.s.i. for 50 min. The cooking time is reduced for stored and partly fermented bagasse. The cooked bagasse, containing 80–85% of the original bagasse, is diluted to 0·5–1·0% consistency (raw pulp) in a beater or refiner. The pulp is screened over an 80-mesh screen to remove fine particles and black liquor, and the thick pulp is re-diluted to 1% consistency and passed through a coarse screen; the coarse fibres (diameter > 1 mm) are returned to the beater. The screened stock pulp, containing not less than 80·0% of fine pulp and not more than 2·5% of coarse fibres, is sent to the board forming machine and formed into wet sheet. After cold pressing, the sheet becomes wet board (60–65% of water) which is dried at 170°C for 2 hr in a tunnel drier. The resulting soft board is formed into hard board in a hot press at 230°C. If the soft board is bone dry, it is pressed for 120 sec at 1500 p.s.i. (dry pressing); if the soft board contains 2% of water, the board is pressed for 30 sec at 270 p.s.i. and is then left for a "breathing period" of 40 sec at 18 p.s.i. before dry pressing. The hard board is sent to a hot air tempering chamber for 1 hr at 170°C and is then re-humidified to 5% water content in order to reach the specified water resistance of S-2-S hard board (15–35% water absorption in 24 hr). The yield of hard board is 58–64% on bagasse.

* * *

Sugar cane wax. II. Examination of the constituents of sugar cane cuticle wax by gas chromatography. Z. H. KRAUZ, J. A. LAMBERTON, K. E. MURRAY and A. H. REDCLIFFE. *Australian J. Chem.*, 1960, **13**, 498–505; through *S.I.A.*, 1961, **23**, Abs. 140.—The distillate from sugar cane cuticle wax under reduced pressure was further examined to determine the chain-length of the individual constituents and their percentage composition. The alcohols were freed from aldehydes by separating the latter as semicarbazones, and other non-aldehydic constituents were separated by chromatography on alumina; in another method, the aldehydes were oxidized to acids and separated by chromatography. The alcohols obtained by the first method were converted to iodides and then were reduced to the corresponding hydrocarbons with lithium aluminium hydride; the hydrocarbon mixture was analysed by gas chromatography. The aldehydes were examined by oxidation to acids (on melting the wax in air), saponification of the oxidized wax to recover acids from esters formed, conversion of the acids (via methyl esters, alcohols and iodides) to hydrocarbons which were also separated by gas chromatography. Free acids from the original wax are also covered by this analysis. Naturally present hydrocarbons could be separated by chromatography on alumina after the aldehydes had been oxidized to acids. The aldehydes, alcohols and acids were all straight-chain compounds, principally of even carbon number with C_{28} predominant (60–73 weight %) in each case; appreciable amounts of odd carbon homologues were also present. The odd-carbon-number compounds were present in greater proportion in the hydrocarbon fraction, and *n*-heptacosane was the major constituent. The unique type of composition of sugar cane wax, as compared with other waxes, is emphasized.

* * *

The zymological utilization of molasses. K. WENDEL. *Zucker*, 1961, **14**, 265–273.—The utilization of beet molasses for various fermentation processes is surveyed with flow diagrams of schemes for production of fodder and bakers' yeast, alcohol, acetic acid, citric acid, and lactic acid. A table is given showing the complete analysis of a beet molasses sample of German origin, and other tables presented indicating the products obtainable by bacterial fermentation processes, and production figures of various products in the U.S.A.

UNITED KINGDOM

Tool for cutting and dehusking sugar cane. I. JEIFETZ, of Buenos Aires, Argentina. **874,690.** 17th August 1959 ; 10th August 1961.

* * *

Device to clear away the surface of the soil and clean topped beet during harvesting. W. STOLL, of Peine, Niedersachsen, Germany. **875,861.** 9th February 1959; 23rd August 1961.

* * *

Preparing hydroxymethylfurfural. ATLAS POWDER CO., of Wilmington, Del., U.S.A. **876,463.** 22nd February 1960; 6th September 1961.—A hexose or hexose source [glucose, fructose, sorbose, mannose, sucrose, maltose, invert sugar, hightest or blackstrap molasses, etc.] is dehydrated at an elecated temperature (150–220°C) in the presence of an acid catalyst (mineral acid or mixture of an acid and an acidic metal salt) and in a reaction medium comprising 5–70% by weight (10–50%) of water and 30–95% (50–90%) of an organic liquid having a normal b.p. >280°C, this liquid being an acid-stable aliphatic ketone or aliphatic or *cyclo*-aliphatic ether (dioxane).

* * *

Isolating clinical dextran. L. LACKO and J. MALEK, of Prague, Czechoslocakia. **877,688.** 14th November 1957; 20th September 1961.—Native dextran which has been degraded and freed from higher molecular components by means of alcohols and/or acetone and filtered is treated with an alkali metal phosphate to bring about precipitation of the clinical dextran fraction, of MW 40,000–250,000.

* * *

Beet digging wheel. H. C. OPPEL, of Boise, Idaho, U.S.A. **877,909.** 22nd February 1960; 20th September 1961.

* * *

Citric acid fermentation. KYOWA HAKKO KOGYO K.K., of Yokyo, Japan. **878,151.** 6th December 1957; 27th September 1961.—*Penicillium adametzi* Zaleski var. *kuensanii* or *P. restrictum* Gillman and Abbott var. *kuensanii* ATCC No. 13155 is cultured on a nutrient medium containing molasses or raw sugar and $CaCO_3$.

* * *

Itaconic acid fermentation. KYOWA HAKKO KOGYO K.K., of Tokyo, Japan. **878,152.** 7th December 1957; 27th September 1961.—*Aspergillus itaconicus* is cultured on a medium containing sugar solution (molasses) equivalent to a glucose concentration of 15–20% and 0·01–0·5% by weight of an organic or inorganic N source ($NaNO_3$, NH_4NO_3 or peptone.).

* * *

UNITED STATES

Liquefying granular materials (sugar). P. H. LOTT, *assr.* UTAH-IDAHO SUGAR CO., of Salt Lake City, Utah, U.S.A. **2,975,038.** 15th April 1958; 14th March 1961.—A granular bulk solid (sugar) and a liquid solvent (water) are simultaneously introduced into the top of a closed (mobile) mixing chamber, free air being excluded. The sugar follows one flow path, while the solvent is directed in a number of jet streams alternately staggered with respect to each other and a common horizontal axis into a separate flow path acutely intersecting the flow path of the sugar while freely falling in the chamber, thereby attaining a substantially intimate mixing. The intermixed flow is intercepted by a baffle so as to change its direction abruptly, break it up into a spray of reduced velocity and complete the dissolution. The solution collecting in the bottom is then discharged from the chamber and is recycled until it has reached the required concentration when it is stored in a separate tank. The mixing chamber is subsequently completely filled, with periodic circulation between both tanks, with measures to minimize condensation and bacterial growth.

* * *

Cane (leaf) stripper. J. J. MUNSON, of Houma, La., U.S.A. **2,982,289.** 4th February 1958; 2nd May 1961.

* * *

Process for removing sugar from sugar cane. F. C. GAIENNE and B. R. GARRARD, of Thibodaux, La., U.S.A. **2,992,140.** 8th October 1958; 11th July 1961. Clarifier muds are treated by a velocity separation process in a centrifugal to recover the sugar juice content which is returned either to the main body of juice before liming or to the clarified juice.

* * *

Process for manufacturing rayon pulp of high purity from bagasse. S. OKUNO, by H. OKUNO and T. OKUNO, of Tokyo, Japan. **2,992,155.** 6th November 1956; 11th July 1961.—Raw bagasse is loosened and screened in a dry state to remove the pith powder and the fibres boiled (at 150–170°C for 1–2 hr) in a fresh 0·05–0·2% acetic acid solution (of pH 4–5), whereby pentosan and silicic acid are removed. The fibres are then treated with a caustic soda solution containing sodium sulphide.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

EUROPEAN BEET SUGAR PRODUCTION ESTIMATES[1]

	1961/62 (*est.*)	1960/61	1959/60
West Germany*	1,350,000	2,000,000	1,422,025
Austria	225,000	277,000	302,340
France	1,540,000	2,788,115	1,077,812
Belgium/Luxembourg	400,000	508,400	216,310
Netherlands	560,000	725,168	509,700
Denmark	217,000	339,000	352,000
Sweden	300,000	358,279	284,734
Italy	925,000	1,022,000	1,437,672
Spain	562,000	496,923	528,028
Yugoslavia	240,000	301,000	274,051
Switzerland	35,800	36,792	42,890
United Kingdom	850,000	1,001,917	872,960
Finland†	61,000	63,561	47,718
Ireland	180,000	132,571	141,977
Turkey	433,000	714,997	555,274
East Germany	650,000	900,000	633,105
Czechoslovakia	950,000	1,150,000	733,000
Hungary	420,000	484,000	391,900
Poland	1,550,000	1,533,000	994,400
Albania	13,000	14,000	13,500
Roumania	360,000	360,000	363,336
Bulgaria	160,000	240,000	172,600
U.S.S.R.	8,200,000	7,100,000	6,100,000
Total	20,182,800	22,546,723	17,467,332

[1] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (8), 125.
* Excluding sugar made from foreign beets.
† Including sugar made from Danish beets.

Revised Standard Scale for pH.—A new British Standard Specification for the pH scale has been issued (B.S. 1647:1961). Originally pH was intended to denote $-\log_{10} C_H$ where C_H is the hydrogen ion concentration. It is now realized that this quantity is not measurable and it is necessary to define pH in terms of the method of measurement, and since more than one definition is possible on this basis there is need for a standard pH scale. In B.S. 1647, which was first published in 1950 as a result of an initiative by the Royal Society, the plan adopted is to define the difference in pH between two solutions in terms of a specified electrometric measurement and to complete the definition by assigning a value of pH at each temperature to one chosen solution, termed the primary standard. The definition applies to aqueous solutions within certain limits and is intended to ensure that when different workers refer to a stated measured pH they mean the same thing within ±0·005. Thus there is no practical difference between the B.S. scale and that of the U.S. National Bureau of Standards. The primary standard is a 0·5M solution of potassium hydrogen phthalate, and the range of temperature covered is now increased to 0–95°C. Recommendations for the use and calibration of the glass electrode are included, together with information on the pH values of aqueous solutions suitable for this purpose.

* * *

Puerto Rico sugar production[2].—Sugar production in Puerto Rico during the 1960/61 crop amounted to 1,095,751 short tons as compared with 1,006,385 tons manufactured in the previous season.

* * *

Hawaii cane variety changes[3].—Cane variety 37-1933, leading variety in Hawaii for ten years, has now lost place to variety 44-3098. Both varieties were grown on smaller acreages than in 1960 but the drop was greater with 37-1933. Third place was held by 38-2915 although it too dropped, while increasing areas were grown to the varieties 49-5 and 50-7209. New plantings were the highest since 1951, a feature attributed to the need to plough fields which had suffered excessive harvesting damage. Leader among new plantings was 50-7209 with 49-5 second.

The Late LEWIS EYNON

IT is with great regret we report the death of LEWIS EYNON on the 18th October 1961. He was born in 1878 and studied at Finsbury Technical College during 1895–99. From 1900 to 1910 he held the appointment of Chemist to the Beetroot Sugar Association (later the Sugar Association) of London, and from 1910 to 1951 was in partnership with the late J. H. LANE as consulting sugar analysts. More recently he was in partnership with J. H. DEFRATES and L. R. F. FORSYTH, retiring last year.

He obtained the B.Sc. Honours degree in 1904 and became an Associate of the Institute of Chemistry in 1900 and Fellow in 1903. He served on the Council of the Institute (now the Royal Institute of Chemistry) and subsequently as Vice-President. He was Honorary Secretary of the Society of Public Analysts from 1936 to 1947 and President from 1947 to 1949.

He was closely associated with the International Commission for Uniform Methods of Sugar Analysis for many years and was elected Honorary Secretary in 1932; Honorary Secretary and subsequently Chairman of the British National Committee, resigning the latter office in 1954. He was elected Life Honorary Vice-President of the Commission in 1954.

Although handicapped in later years by increasing deafness he took a lively interest in the development of modern techniques in sugar analysis. The discovery that methylene blue is a sensitive indicator for the determination of reducing sugars with Fehling's solution was a valuable contribution to sugar analysis and the Lane-Eynon method has been widely used for many years.

Bagasse boarding plant in Louisiana[4].—The National Bagasse Products Corporation, a newly organized company, is at present building a plant at Vacherie, Louisiana, and plans to begin production of hardboard, composition board and insulation board at the beginning of 1962. The products will be used for furniture manufacture, insulation, sound-proofing, as building material in flooring, roofing, shelving, etc.

* * *

French West Indies sugar factory[5].—The Société Centrale pour l'Equipement du Territoire plans to erect a new sugar factory on the island of Marie Galante. The plant is to have a daily processing capacity of 1500 tons of sugar cane.

[2] C. Czarnikow Ltd., *Sugar Review*, 1961, (523), 154.
[3] *Sugar News* (Hawaii), 1961, **11**, (7), 2.
[4] *Sugar y Azúcar*, 1961, **56**, (9), 50.
[5] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 15), 201.

BREVITIES

Sugar cane agriculture training[1].—In response to a number of requests, the South African Sugar Technologists' Association, in collaboration with the Dept. of Agricultural Technical Services, the Cedara College of Agriculture and the Natal Technical College, has designed a course of training in sugar cane agriculture. The course is intended for field overseers, learner overseers and others engaged in growing sugar cane and is essentially a practical course for practical men. It is limited to students of European descent only. The syllabus covers botany, plant pathology, entomology, general sugar cane agriculture, agricultural mechanics (concerned with tractors, implements, etc.), soil science, irrigation, surveying, farm management, field experimentation, etc., and will be given partly in Pietermaritzburg and partly in Durban.

* * *

Greek sugar factories[2].—The foundation stone of the second Greek sugar factory[3] was laid on the 3rd September at Serres in Northern Greece. The factory, which is being build by the Polish organization CEKOP, will have a daily capacity of 2000 tons of beet and should start operations in August 1963. The first factory at Larissa started operations on the 26th August and in its first campaign[4], which lasted to mid-September, sliced about 35,000 tons of beet, producing 3000 tons of sugar. In a full campaign of 100 days it should slice about 200,000 tons of beets to produce 28,000 tons of sugar or a third of domestic requirements. The foundation stone of the third sugar factory at Platy near Thessalonikki was to be laid in October.

Stock Exchange Quotations

	CLOSING MIDDLE
London Stocks (*at 17th October*, 1961)	
Anglo-Ceylon (5s)	12/6
Antigua Sugar Factory (£1)	5/–
Booker Bros. (10s)	21/3
British Sugar Corp. Ltd. (£1)	33/6
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	12/–
Distillers Co. Ltd. (10s units)	34/3
Gledhow Chaka's Kraal (£1)	22/6
Hulett & Sons (R1)	9/–
Jamaica Sugar Estates Ltd. (5s units)	4/–
Leach's Argentine (10s units)	25/6
Manbré & Garton Ltd. (10s)	35/6
Reynolds Bros. (£1)	25/–
St. Kitts (London) Ltd. (£1)	16/–
Ste. Madeleine (Ord.) (£1)	27/6
Sena Sugar Estates Ltd. (10s)	8/–
Tate & Lyle Ltd. (£1) (Old)	43/3
Tate & Lyle Ltd. (£1) (New)	39/–
Trinidad Sugar (5s stock units)	37/–
United Molasses (10s stock units)	30/–
West Indies Sugar Co. Ltd. (£1)	14/6

	CLOSING MIDDLE
New York Stocks (*at 16th October*, 1961)	$
American Crystal ($10)	46
Amer. Sugar Ref. Co. ($25)	31⅛
Central Aguirre ($5)	24⅜
Cuban American ($10)	15½
Great Western Sugar Co.	34¾
South P.R. Sugar Co.	23½
United Fruit Co.	24⅝

Cuban sales in 1962[5].—Dr. FIDEL CASTRO announced on the 28th September that "socialist countries" had guaranteed to buy 4,500,000 tons of Cuban sugar in 1962 and the next four years at above world market prices. News of the agreement—which meant that Cuba would sell a total of 6,500,000 tons in each of the next five years—had just been conveyed to him by President DORTICOS and the leader of the Popular Socialist Party who were in Peking after visiting Moscow. On returning to Cuba, President DORTICOS announced[6] that, of these sales, 3 million tons would be to the U.S.S.R. and 1·2 million tons to China and that other Communist countries would bring sales up to 4,870,000 tons a year.

* * *

Bagasse paper factory for Spain[7].—Empresa Nacional de Celulosa de Motril plans to erect a factory at a cost of 400 million pesetas (£2,400,000) which will utilize 40,000 metric tons of bagasse yearly to produce 3000 tons of corrugated paper, 7500 tons of wrapping paper and 7000 tons of writing and printing papers.

* * *

F. O. Licht centenary. To mark their centenary on the 1st September 1961, the well-known statisticians, F. O. Licht K.G. of Ratzeburg, Germany, have published a book entitled The World Sugar Economy 1936/37—1960/61. It covers the world sugar situation and future prospects in considerable detail and with a wealth of statistics, and includes a section devoted to developments in the techniques and chemistry of sugar production during the past 25 years. The price is DM. 24·00 post free.

* * *

Second Swiss sugar factory[8].—The foundation stone of the second sugar factory was laid recently near Frauenfeld, Switzerland. The factory is to be put in operation by the end of 1963. Building costs were estimated at 34 million Swiss francs when the factory was proposed in 1954, but have now risen to 44 million. Economically, conditions are rather unfavourable for the factory because of the low price of refined sugar on the Swiss market, but proposals have been made to protect the domestic sugar producer.

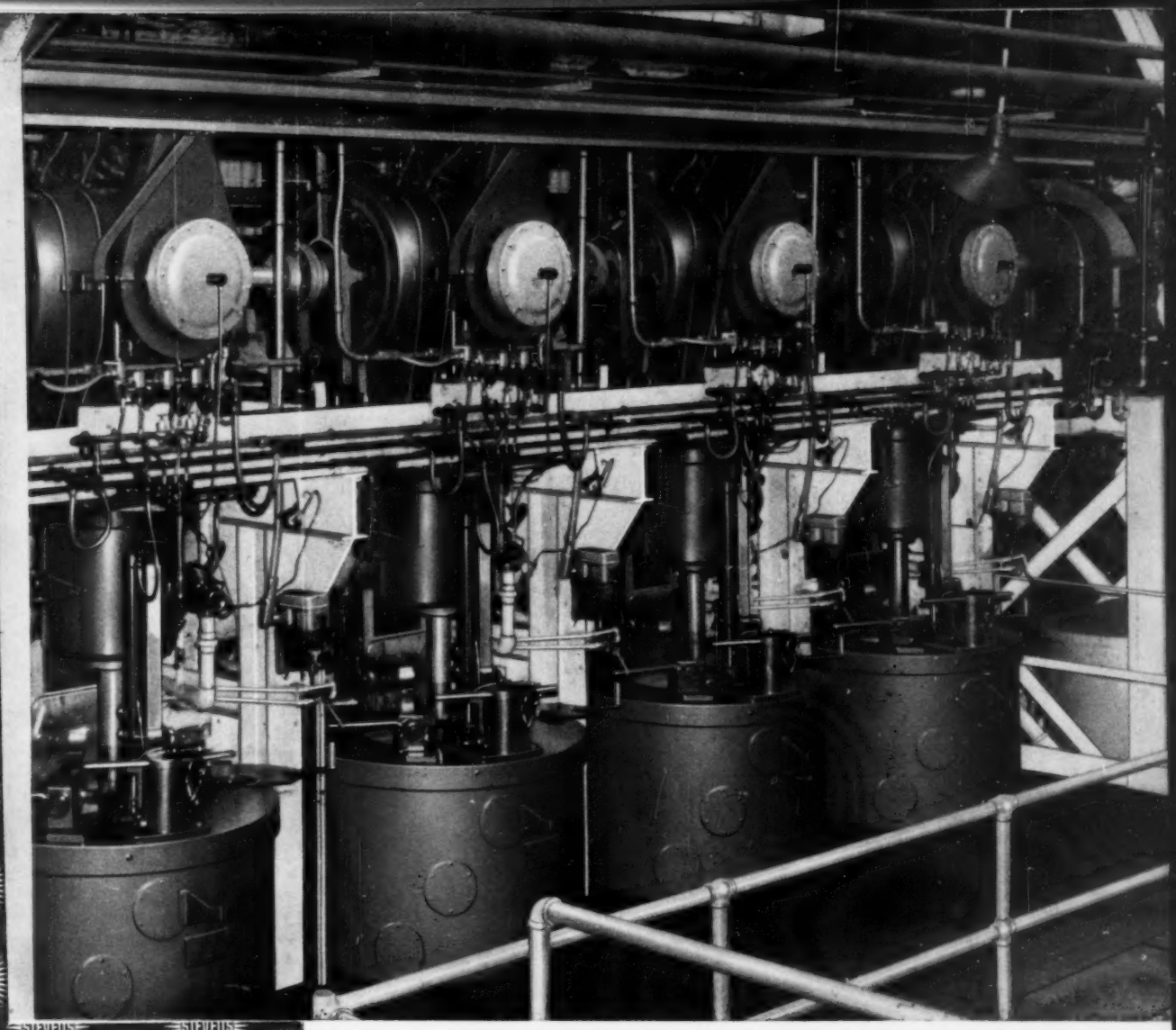
* * *

Sugar Research Foundation projects for 1961/62.—Twenty-five research projects—studies in food technology and sucrochemistry—will be supported in the 1961/62 programme of the Sugar Research Foundation Inc., according to Dr. JOHN L. HICKSON, Director of Research. The Foundation, supported by the sugar industry, has budgeted more than $300,000 for the 1961/62 research programme. Studies in food technology will measure the effect of a balance between sugar and other taste factors on the consumer acceptance of foods. Studies in sucrochemistry will include basic and applied research on non-food uses of sugar, including the use of sugar in developing a low cost family of plastics, new adhesives and cements, high quality paints and printing inks, and other industrial products and techniques.

* * *

Sudan sugar development[9].—The Sudan Government have prepared a detailed plan for the establishment of a £S 10 million sugar refinery at Khashm El Girba, where experiments on sugar cane cultivation have been successful. The output of the refinery, together with the production of the refinery at Guneid, will meet the sugar requirements of the Sudan. Three-quarters iof the machinery of the Guneid plant has been installed and t is to go into operation in 1962.

[1] *S. African Sugar J.*, 1961, **45**, 791–793.
[2] *Zeitsch. Zuckerind.*, 1961, **11**, 518.
[3] See *I.S.J.*, 1960, **62**, 178.
[4] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (8), 131.
[5] *Public Ledger*, 30th September 1961.
[6] *ibid.*, 7th October 1961.
[7] *Bol. Inform. Sindicato Nacional del Azúcar*, 1961, (165), 16–17.
[8] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 16), 208.
[9] *Overseas Review* (Barclays D.C.O.), October 1961, p. 47.



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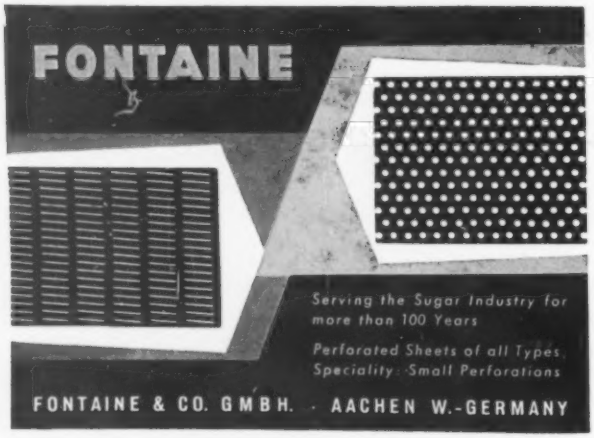
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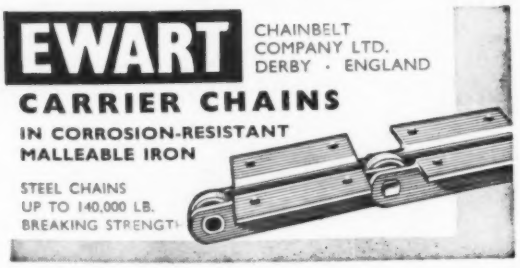

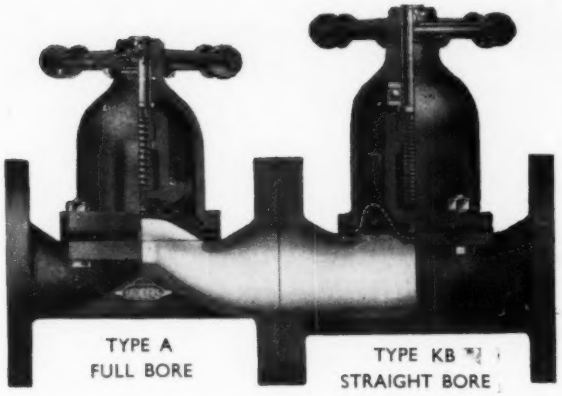

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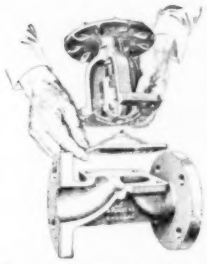

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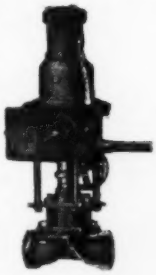

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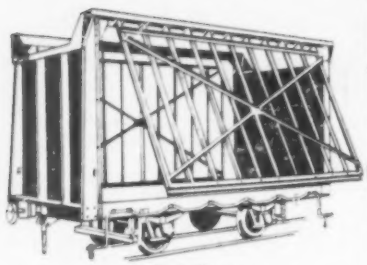
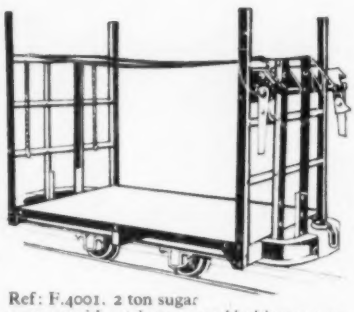


Ref: F.4017. 12 ton four wheel cane car with side doors.



Ref: F.4001. 2 ton sugar cane car with ratchet gear and lashing chains.

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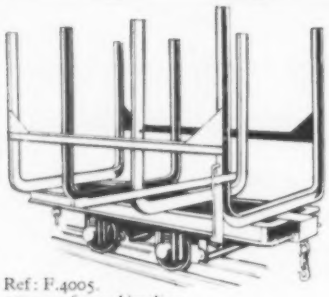
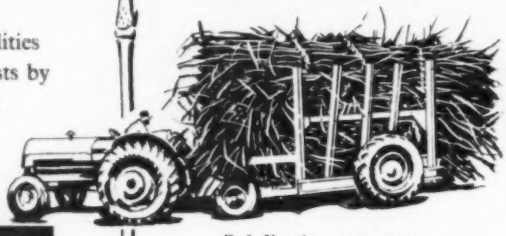


Ref: F.4005. 5 ton car for end loading. Side lever brake.



Ref: F.4061. 5 ton swan neck type sugar cane trailer on heavy duty pneumatics.

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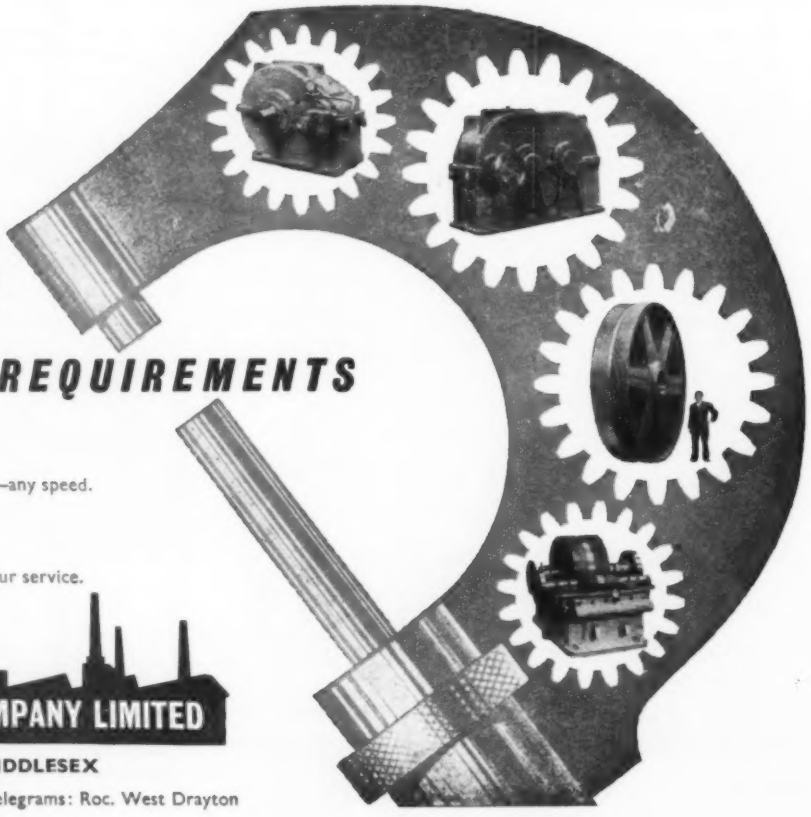

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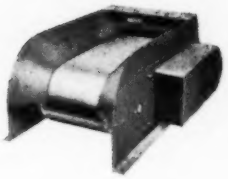

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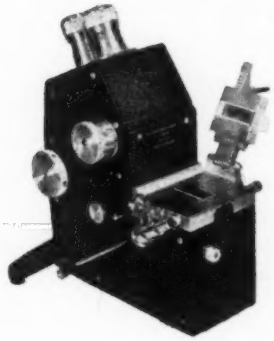

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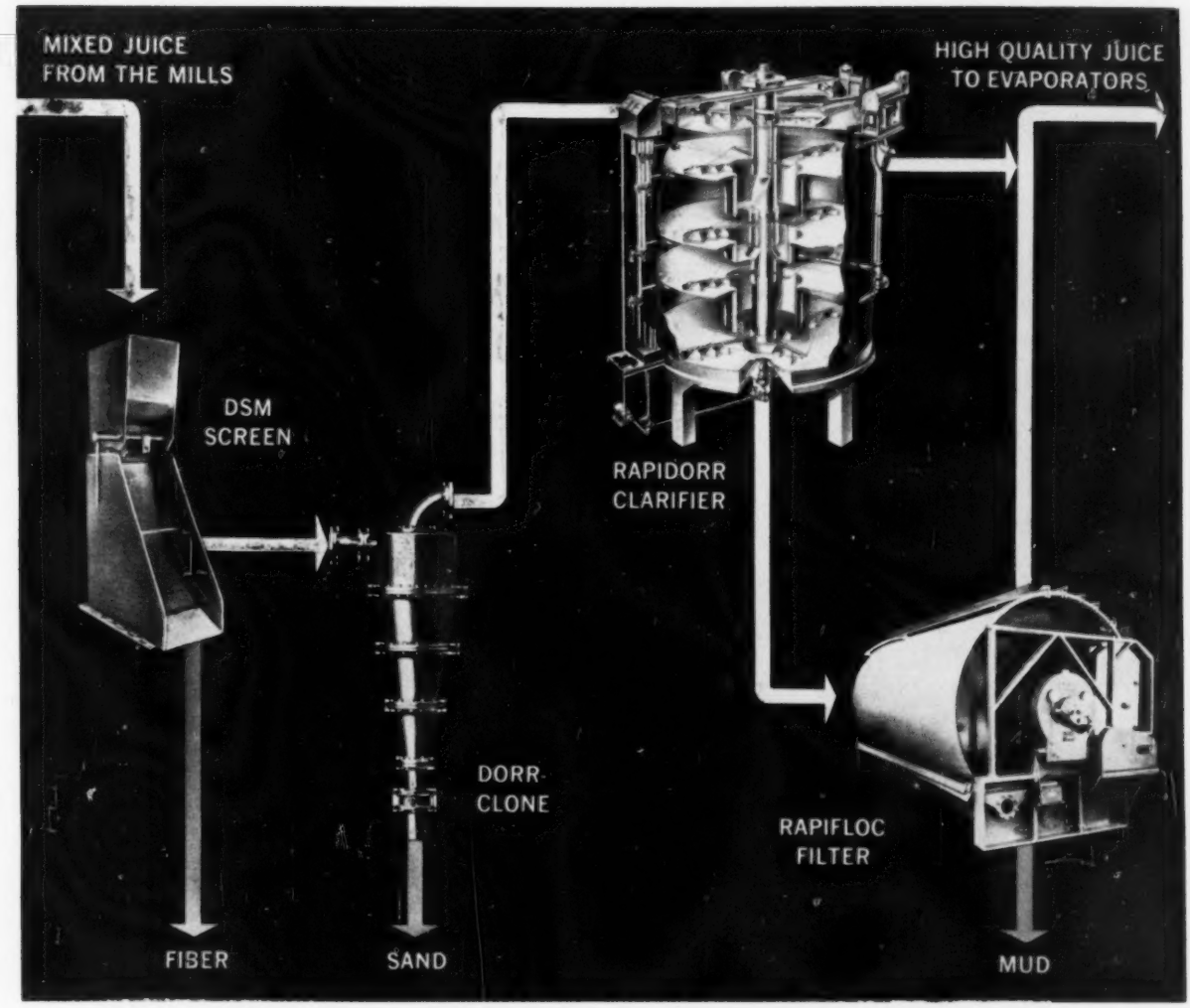

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